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ABSTRACT

Conducted from 1975 to 1977, this reading achievement study examined the effects of initial literacy in Navajo on later reading in English and the effects of initial arithmetic instruction in Navajo on later arithmetic instruction in English by comparing two groups of Navajo students, both of whom began school essentially monolingual in Navajo. The bilingual group consisted of students from Rock Point Community School who had first been taught to read in Navajo and then, at the second grade level, had also been taught to read in English. The second group consisted of students from a selected sample of BIA schools who had been taught to read in English only in English as a Foreign Lanugage (EFL) direct method programs. The study utilized existing programs in carefully selected schools. Students who had received bilingual instruction scored higher on standardized achievement tests than did students at comparable schools who had received English-language-only instruction and better than earlier Rock Point students who had received English-language-only instruction. Also, the bilingual students who were taught arithmetic in Navajo and English until the end of the second grade had significantly higher mean scores on the Total Arithmetic subtests than did the EFL direct method group at grades above the fourth. The major portion of the monograph consists of Appendix A, which describes other related studies and Appendix B, which details the Rock Point Study's methodology, findings of the study, and a statistical analysis. (CM)

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# The Rock Point Experience: A Longitudinal Study of a Navajo School Program (Saad Naaki Bee Na'nitin)

by Paul Rosier and Wayne Holm

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# Foreword

When the Bilingual Education Act was passed in 1968, it was essentially considered as an experimental approach to the problems of pupils in American schools who had limited English speaking ability. Paradoxically, the initial intention was not to deal with the problems of such children unless they spoke Spanish, and as the program developed, there were even more striking paradoxes. Thus, 10 years later we are still arguing about the effectiveness and the goals of the program. One of the most serious failures that can be charged to those responsible for bilingual education over the past 10 years has been in the area of evaluation. While a great deal of emphasis was placed on demonstration projects, on proposals that specified behavioral objectives, and on renewal proposals that reported on the attainment of these objectives, there has been virtually no meaningful research or evaluation associated with the Title VII program.

One striking exception has been the mammoth and expensive USOE-sponsored short term study carried out by AIR to show that bilingual programs do not differentiate as to quality and do not appear to lead to marked increases in English language ability of their students in a six-month period.

The research reported in this monograph is not sponsored by the U.S. Office of Education. It is the record of a school staff working to monitor some innovative programs in which they were engaged in order to be in a position to assure their school board and the parents of their children that the program was educationally viable. Even with its limitations, the study is an excellent model of the kind of research we need if we are to understand more about the effects of educational innovations.

It would not be fair for me to give away all the results of the study, but I would like to draw attention to a number of the features that make it so valuable. The first is, of course, its longitudinal nature. As we know from large numbers of educational studies, so many factors affect achievement in school (and so many of them are not necessarily related to school itself) that effects of changes in curriculum will show up only slowly, and when many other factors are controlled. The basic curricular question posed for those concerned with American bilingual education is whether or not instruction in the child's native language is preferable during the time that the child is achieving mastery of the standard language, English. The two approaches, referred to by Patricia Engle and in this study as the bilingual method and the EFL direct method, each have sufficient justification in theory and practice to be considered educationally viable alternatives. The present study looks at the effect of these two approaches on the English reading and arithmetic scores of Navajo pupils over a six-year period. It shows advantages for the bilingual approach in the situation and evidence as to how misleading results taken after one year would have been. Its first significance, then, is demonstrating that in the study of an innovative educational program we need longitudinal rather than short term studies.

The study is also significant in making clear the importance of various background factors involved in educational studies. The authors do a very good job of describing the community and school in which the program took place and give a good picture of the actual educational innovation. It could well be, as they point out, that the special circumstances of their school and of its community might ultimately turn out to have been more important contributing factors than the particular curriculum. Their description will make it possible to draw appropriate conclusions when we have similar studies of other school programs.

A third significant aspect to this study is one that gives me as much personal as professional pleasure. While I must make quite clear that I have no right to claim responsibility for any portion of this present study, I see it as the logical fruition of a program of work that I have been engaged in for the last nine or 10 years. In 1969, I was asked by some people in the education division of the Bureau of Indian Affairs to consider the possibility of some kind of replication of the Modiano study using the Navajo situation--to consider the possibility of a study of the relative advantages of the bilingual approach and the EFL direct approach to the Navajo situation. The work of the Navajo Reading Study, supported by grants from the Bureau of Indian Affairs, the U.S. Office of Education, and the Ford Foundation, focused on this goal; we were fortunate enough that all our funding agencies accepted our basic premise that no comparison was possible until we had materials and teachers capable of implementing a bilingual approach with Navajo. The Reading Study was involved, therefore, with a great number of preliminary and basic studies rather than with the actual research design that is finally demonstrated in this present publication. Wayne Holm spent two years at the University of New Mexico working as a research assistant at the Reading Study and writing his dissertation on the topic of Navajo orthography. His work at Rock Point School can be seen as a continuation of this project, and the present study is an answer to questions originally (but patiently) posed by people at the BIA and the Ford Foundation. Paul Rosier was the bilingual education coordinator at Rock Point School. His doctoral dissertation dealing with the results of the Rock Point program formed the basis of this monograph.

If I might venture my own summary of the lesson to be learned from the Rock Point bilingual program, it is this: In a community that respects its own language but wishes its children to learn another, a good bilingual program that starts with the bulk of instruction in the child's native language and moves systematically toward the standard language will achieve better results in standard language competence than a program that refuses to recognize the existence of the native language. In this traditional Navajo community, a school under the control of the members of the community has developed bilingual programs with their approval. Whatever other results there may have been (and I refer here, of course, to the community control, to the strength of Navajo values, to the continued growth for the pupils in their Navajo language skills), one marked effect has been much greater success in the teaching of reading in English and arithmetic than achieved by other approaches. The study shows a set of circumstances in which a bilingual program appears to be meeting the needs of a community better than any other approach.

*Bernard Spolsky*
*University of New Mexico*

# Introduction and Summary

Bilingual education in the United States is enveloped in controversy. Educators and noneducators argue about the value, if any, of teaching children of limited English speaking ability in their dominant or native language.

Does instruction in the native or dominant language have any effect, positive or negative, on English language development? This question is addressed in the monograph which follows. The studies were conducted on the Navajo Reservation where approximately 90 percent of the children enter school speaking Navajo. The primary focus of the monograph is on achievement in English reading, particularly how introducing Navajo students to reading in the Navajo language affected their later ability to read in English. It also looks at achievement in arithmetic and achievement in English language proficiency.

To do this, we have compared two groups of Navajo students, both of whom began school essentially monolingual in Navajo. The *bilingual* group consisted of students who had first been taught to read in Navajo and later, at the second grade level, had also been taught to read in English. These students continued to receive reading instruction in both Navajo and English through the sixth grade, the highest grade then offered at the school. The other group consisted of students who had been taught to read in English only in *monolingual* English as a Foreign Language (EFL) direct method programs. Existing programs were used in the study. Schools were carefully selected, and the programs in all schools had been well established before these studies were undertaken. Consequently, these studies do not purport to be scientific experiments; they are studies of "things as they are" or "were."

The reading achievement study, conducted from 1975 to 1977, examined the effects of initial literacy in Navajo on later reading in English. The Stanford Achievement Test (SAT) was the principal instrument used, with the Metropolitan Achievement Test (MAT) also used in 1976. Students were tested in grades two through six, except in 1975, when only second through fifth grade scores were reported. Mean scores for Total Reading and its constituent subtests are compared.

The arithmetic achievement study examined the effects of initial arithmetic instruction in Navajo on later arithmetic in English, and it involved the same groups as the reading achievement study. Only the SAT tests for grades two through five for 1975 were compared. Mean scores for Total Arithmetic and its constituent subtests are compared.

The English language proficiency study studied the effects of reduced English language instruction time on English language proficiency. The Test of Proficiency in English as a Second Language (TOPESL) was used with the bilingual group students in 1975 and 1976. The mean scores on the two subtests administered are compared with mean test scores for the EFL-only group in 1974. Only grades four through six were tested.

The bilingual method school in this monograph was Rock Point Community School. The reading and arithmetic studies compared achievements of Rock

Point students with achievements of students in a selected sample of Bureau of Indian Affairs (BIA) schools. These schools comprised the EFL direct method group or Area sample. The English language proficiency study compared Rock Point student achievement with the achievement of students in all or most of the Bureau of Indian Affairs schools on the Navajo Reservation.

Rock Point is a community controlled "contract" school on the Navajo Reservation.[1] As a contract school with a largely nondegreed staff and an atypical, bilingual curriculum, the school has had to become evaluation conscious to survive.

The senior author was the school's Title VII (bilingual education) coordinator from 1973 through 1975, a doctoral candidate (1975 through 1977), and, more recently, assistant director of the Native American Materials Development Center. The junior author was the school's principal when it was a Bureau school and has been its director since the school "went contract" in 1972. This monograph has its origin in Rosier's doctoral dissertation, "A Comparative Study of Two Approaches of Introducing Initial Reading to Navajo Children: The Direct Method and the Native Language Method" (Rosier, 1977). The dissertation focused on achievement in reading in English, as tested with the Stanford Achievement Test (SAT) at Rock Point and at selected Bureau schools during a three-year period (1975 through 1977).

The senior author sought and obtained the assistance of the Navajo Area Education Office. They were most cooperative, as was the academic leadership of those Area schools that agreed to participate. The SAT was administered only once in these schools, in February of 1975. Some gaps were later found in the data; these are not extensive and have been noted in the text. Every effort was made to analyze the available data in a rigorous manner. This monograph makes use of additional data, which has not been as rigorously analyzed as that in the dissertation.

Although this monograph depends almost entirely upon standardized achievement test data, the subject school--Rock Point--does not rely very heavily on such data. The school's evaluation activities center on the ongoing administration of locally developed criterion-referenced tests, with copies of the results going directly to the responsible classroom teachers. Standardized achievement test results are required as part of the formal evaluation of the "Main" (BIA) contract and the Title I and Title VII grants. The school has little faith in, and makes almost no use of, individual test scores; it has somewhat more confidence in group or grade means for 20 or more students. Despite cultural and language differences between Rock Point students and those students with which these tests were normed, it is useful to learn, once a year, where the school stands vis-a-vis national norms. In a sea of 210 million people, 160,000 Navajos are a small language island.[2] We feel that those reservation educators who would substitute "Navajo norms" for "national norms" are deceiving themselves.

There is probably some transfer from specific criterion-referenced tests (many of which are administered individually) to standardized achievement tests (which are group administered), and, as a result, Rock Point students may be somewhat "testwise." The school is touchy, however, about accusations that they "teach the test." In most Navajo Area schools, achievement tests have been administered by the classroom teacher, a practice which Eugene Brière[3] has said (orally) tends to elevate scores by as much as one standard deviation. At Rock Point, such tests are administered by nonclassroom teachers, and area observers are invited to monitor test administration.

We are rather skeptical of the textbook educational research design which purports to compare the effects of "treatment X" to those of "treatment Y" while "controlling" all other "variables." Education involves groups of people in interaction and, consequently, the variables are too many and too complex to be completely "controlled." In our use of the term, "control" group should be understood to refer to "the group of those students (who took the tests) from the sample of otherwise comparable Bureau schools with EFL direct method programs."

We have tried to design an honest study. We selected some of the better Bureau schools for comparison, and we continued to have tests administered by persons other than the classroom teacher, despite the fact that teachers usually administered the tests to their own students at the Area schools. We have described the experimental situation as carefully and objectively as we, as participants, could. We have presented the data with consideration for fairness--combining three years of Rock Point means to minimize year-to-year differences; omitting Rock Point's sixth grade arithmetic scores, although favorable to Rock Point, because of the small number of students involved; and noting gaps in the data where these exist. Finally, we have noted alternative conclusions to the data and, where we could, adduced additional data to show why we retain the conclusion stated.

The major results may be summed up as follows. Despite the fact that they did not begin reading in English until midway through the second grade, the bilingual group had statistically significant higher mean scores on the SAT subtests for Total Reading than did the EFL direct method group at all grades above the third. Similar results were obtained with the MAT subtests for Total Reading.

Also, the bilingual students, who were taught arithmetic in Navajo and English until the end of the second grade, had statistically significant higher mean scores on the Total Arithmetic subtests than did the EFL direct method group at grades above the fourth. At each higher grade, the bilingual group's mean scores for Total Reading and the Total Arithmetic tended to diverge further from those of the EFL direct method group and converge closer to those of the national norms.

Rock Point fourth graders who had received continuous bilingual instruction did better on SAT Total Reading subtests than did Rock Point fourth grade students who had received interrupted bilingual instruction. Despite the fact that most of their Rock Point teachers were nondegreed, Rock Point sixth graders, most of whom had received bilingual instruction, did better on the 1977 SAT Total Reading subtests than the Rock Point sixth graders, who received intensive EFL direct method instruction from degreed teachers, had done in 1970. And despite receiving less daily exposure to instruction through English, the bilingual group's mean scores on subtests of the Test of Proficiency in English as a Second Language were markedly higher than those of the EFL direct method group.

We cannot claim to have proved anything as abstract as "bilingual education is better than. . . ." We have attempted to show that at Rock Point, Navajo students who had received bilingual education did better on standardized achievement tests than did Navajo students at comparable schools who had received English-language-only instruction; they also did better than earlier Rock Point students who had received English-language-only instruction.

## NOTES

1. A "contract" school is one where a tribe or tribal organization has contracted with the Bureau of Indian Affairs to operate a previously federal or private (nonfederal) school under the terms of PL 93-638.
2. The Navajo population figure of 160,000 is the 1979 figure. No other statistics have been updated from their 1977 level.
3. Eugene Brière, personal communication.

# Overview of the Navajo Situation

## THE NAVAJO TODAY

The Navajo[1] are an Athabaskan speaking people living in the southwestern United States. About 160,000 live on or near the West Virginia-sized reservation in New Mexico, Arizona, and Utah. They are the largest Indian tribe in the United States. The reservation is also the largest in the United States, but it is not capable, at this time, of providing an adequate living for the people. Today, as individuals, Navajos are (on the average) among the poorest Americans.

The reservation is badly overgrazed. Rainfall is scant and the development of the major source of water for irrigation, the San Juan River, is just beginning. Despite development of mineral/fuel extraction and energy related activities, expansion of federal service jobs and job development activities, and attempts to develop light, waterless industrial activities, the reservation seems to be drifting farther from, rather than toward, economic self-sufficiency.

For most Navajos, sustained contact with the Anglo socioeconomic world came relatively late--with or since World War II. Mass education came even later. As late as 1948, only half of the Navajos between the ages of six and 18 were in school. Only since 1953 has there been what might be considered near-universal education.

Given the relatively large land base, the relatively large population, and the late arrival of near-universal English language education, the Navajos are the largest Native American language island in the United States. Navajo is still *the* language of two out of three homes; about 90 percent of the children entering school are monolingual or dominant in Navajo. Bilinguals are increasing, but with the high birthrate and the relatively high incidence of the use of Navajo at home, the number of Navajo speakers is still increasing. Navajo is not a dying language!

## NAVAJO EDUCATION SYSTEMS

The original schools on the reservation were boarding schools, generally located at government administrative centers--the "Agency" headquarters. During the mid 1930s, the Bureau of Indian Affairs built some 50 community day schools on the Navajo Reservation which became the infrastructure of the Navajo education system (Thompson, 1975).

During World War II, there was a shift to community boarding schools; after the war, to large on- and off-reservation boarding schools. With postwar emphasis on integration, relocation, and termination, government funds made possible massive reservation-wide construction of both public schools for day students and Bureau boarding schools. Thus, the peculiar arrangement of multiple, overlapping school districts and systems came about.

Today, there are about 60,000 Navajo children between ages five and 18. An increasing number, approaching two-thirds, of these children now attend public schools. A decreasing number, roughly one-third, now attend BIA schools; most of these students are unable to attend public schools on a day basis because of poor roads. Smaller numbers of children attend community controlled contract schools, mission schools, and other special purpose schools.

The basic nonbiological social unit above the extended family is the "community." The Tribe recognizes 102 such communities, politically organized as Chapters. Although the Bureau schools of the 1930s were basically one-community schools, today *most* public and Bureau schools do not serve single communities. Public schools tend to be located in off-reservation or emerging on-Reservation towns. Bureau schools, compensating for the loss of day students to the public schools, tend to draw boarding students from communities farther away. Most schools--public and Bureau--draw students from a number of communities, and most communities send students to a number of schools.

Public school boards tend to be made up of professionals from the off-reservation or emerging on-reservation towns; they must work within the system of the Anglo-oriented state school system. The Bureau school boards are, by their constitution, strictly advisory. (Or they were at the time this was written. Legislation passed by the 95th Congress will increase the powers of these boards without giving them "control" of their schools.) Thus, rural Navajo community people have relatively little influence on the education of their children in Bureau or public schools.

Navajo children have not, as a group, done particularly well in school. The reasons for this are many and go beyond serious basic problems of finances. This does not mean that *all* schools and *all* students do poorly; there *are* students who do well. Most Navajo parents do not realize just how low Navajo "norms" are. It is doubtful that there will be significant action to improve the quality of education until parents become more aware of the real situation.

Table 1 displays a comparison of Navajo Area student achievement with the national norms in second through sixth grades in 1972, using Stanford Achievement Test results.[2]

Table 1. *A Comparison of Navajo Student Average Achievement Scores and the National Norms on the Paragraph Meaning Subtests of the Stanford Achievement Test.**

| Grade Level | National Norm | Average Grade-level Equivalent for Navajo Students | Difference Minus/Plus |
|---|---|---|---|
| Second | 2.5** | 1.8 | .7 |
| Third | 3.5 | 2.4 | 1.1 |
| Fourth | 4.5 | 2.7 | 1.8 |
| Fifth | 5.5 | 3.6 | 1.9 |
| Sixth | 6.5 | 4.1 | 2.4 |

**The document cited does not give the number of students involved in the testing, but it is assumed that at least 5,000 students were tested.*
***The National Norm is determined by the date of the administration of the test. The test was administered in February, 1972.*

Navajos call public schools *bilagáana yázhí bi'ólta'*, "Anglo(s)/little/ school(s)." The proportion of non-Navajo students may range from a few to a majority depending on location. The Navajo students tend to enter public schools speaking more English than do students in Bureau schools, but it appears that these initial language advantages are not being translated into demonstrated advantages on achievement tests (Spolsky and Holm, 1971 and Appendix A). Until recently, there have been very few Navajo teachers. The Navajo Division of Education estimates that there are only a few hundred Navajo teachers on the reservation serving the school-age population.

## Monolingual and Bilingual Programs

The Navajo Area had a relatively sophisticated word control approach to teaching English on the reservation in the late 1930s and early 1940s. This was lost in the rapid postwar expansion of the Bureau school system in the 1950s. The Navajo Area began putting heavy emphasis on English as a Foreign Language (EFL) training and materials development only in the late 1960s. (English as a Foreign Language seems to be the most appropriate term for programs designed to systematically teach English to non-English speakers [Holm, 1973].) It is our impression that, despite continued training and materials development, EFL programs are, at best, school level programs --some schools have good EFL programs, most do not. Public schools tend to have more non-Navajo and English speaking Navajo students; therefore, they have tended to perceive English as less of a problem and EFL approaches as less appropriate.

The Navajo Area has had several EFL direct method programs developed specifically for Navajo children. These programs have been refined and organized into two curricular approaches that are presently used in Area schools. Consultants In Total Education (CITE) and the Navajo Area Language Arts Program (NALAP) materials are used in many of the Area schools on the Navajo Reservation in grades one through three.

The approaches mentioned to this point have all been *mono*lingual English programs in which English is the *only* language of instruction. In the late 1960s, an alternative approach was introduced on the reservation; it incorporated EFL as one component and instruction *through* Navajo as the other component, thus forming a *bi*lingual approach. (We make the distinction between teaching Navajo and teaching *in* or *through* Navajo. At Rock Point, Navajo is used as a *means* of instruction. While no doubt the students are learning more adult Navajo, the subject matter is reading, arithmetic, Navajo social studies, etc., not the acquisition of Navajo. The role of Navajo is comparable to that of English in English-only classrooms.)

Continuous Navajo text was written as early as the 1890s and there seems to have been some use of written Navajo before World War I. A good, *practical* orthography has been available since 1940 when some materials also were developed. However, there appear to have been no school-wide bilingual education programs before the establishment of the Rough Rock Demonstration School in 1966.

Most Navajo students still arrive at school speaking relatively little (or no) English, and most are taught in English by non-Navajo speaking teachers. Some students are taught English as a foreign or second language, but very few are taught in Navajo. In a small number of schools--public, Bureau, contract, and mission--efforts are being made to teach in Navajo.

The EFL direct method (the term is Engle's; see Engle, 1975) approach introduces the child to English using oral-aural techniques. After a certain

proficiency in English has been developed, usually after the first year, reading and arithmetic are introduced in and through English. EFL-related techniques are used to teach reading; vocabulary, spelling patterns, and syntactical structure are controlled. Ideally, the EFL oral language activities and the EFL controlled reading techniques continue to be used until the child becomes a proficient speaker and reader of English.

The bilingual approach introduces reading in the native language first. Reading in English begins after the child has become a proficient reader in the native language, at the second or third grade level. Most of the essential concepts of *reading* should transfer from reading in Navajo to reading in English. EFL instruction is provided while the child is learning to read in the native language. The bilingual method allows children to learn to read in the language they understand while developing proficiency in the other language. All other content subjects taught in the program, including arithmetic, are introduced in Navajo. Arithmetic *concepts* are taught in Navajo; the English *language* needed for arithmetic in English is introduced later, as a specialized sort of EFL.

## Which Approach?

Both approaches are designed to help the child become a competent English speaker. Both have as one of their goals the proficient development of the basic skills of reading, writing, and arithmetic. The bilingual approach, however, is also intended to develop abilities in Navajo not addressed by the EFL direct method approach. We do not mean to minimize these; we feel they are very important. We would say that a bilingual program in which students do *as* well in English as students in a monolingual program, and also do things well in Navajo not done by students in the monolingual program, has done *more* and has done *better* than the monolingual program. But this monograph is intended to address the more limited question posed by "hard-headed pragmatists:" what are the effects of bilingual instruction on achievement (as measured by standardized achievement tests)?

The problem for Navajo educators is which approach allows Navajo children the best opportunity to develop English language proficiency and competence in basic skills, reading, and arithmetic to their greatest extent. The purpose of this study was to determine the effects of each of these two approaches on the development of English reading ability, English-mediated arithmetic ability, and overall English language proficiency. (See Appendix A for literature pertinent to this problem.)

## NOTES

1. The spelling *Navaho* occurs in some of the anthropological literature; the older Spanish spelling *Navajo* is the one sanctioned by the Tribal Council and will be used here except in citing titles with the other spelling.
2. Results of Stanford Achievement Test, 1972. From the Navajo Area Office, Bureau of Indian Affairs, Window Rock, Arizona, June 9, 1973.

# Component Navajo Schools

## THE EFL DIRECT METHOD SCHOOLS

The seven schools that served as the EFL direct method sample group in this study were all Navajo Area schools. Bureau schools were chosen because their student populations were considered to be more like that of the bilingual method school, and because they had somewhat comparable EFL programs.

The Navajo Area is the Bureau administrative unit roughly comparable to the Reservation as a whole. For administrative purposes, the 19 grazing districts of the Area are divided into five "Agencies." Rock Point Community School--the bilingual method school--is, for educational purposes, under the Chinle Agency. The terms "Area" and "Agency," as used in this study, refer to the Navajo Area and the Chinle Agency, respectively.

The seven Bureau schools were selected after consultation with Area education specialists. All seven had structured EFL programs; all had programs which involved a second adult (however designated) in instruction in at least the kindergarten through second grade classrooms. These schools were considered, by knowledgeable people in the Area education offices, to be among the best of the Area schools at the time, i.e. an honest effort was made to compare the results of the Rock Point program with those of the *best* of the Area schools.

## THE BILINGUAL METHOD SCHOOL (ROCK POINT)

### Background

Tsé Nitsaa Deez'áhí ("Rock/it-is-large/it-extends-horizontally, the one that") is a Navajo community of about 1,400 people on either side of the middle reaches of Chinle Wash in far northeastern Arizona. The community is relatively poor, even by reservation standards. Almost all of the district in which Rock Point is located has been badly overgrazed. Water for irrigation from Lukachukai Wash or Chinle Wash is available in some years and not in others. There were, until recently, few high school graduates and virtually no college graduates from the community. Before the advent of more extensive government financed work and training projects, most Rock Point men worked off-reservation in short term work such as railroad "steel" gangs, forest firefighting, seasonal farming, and mining.

The Bureau built a small two-teacher day school near the trading post in the mid 1930s. Surviving World War II, when a number of schools had to be closed, the school was expanded to become a three-teacher community boarding school in 1953; both day and boarding students attended. Since children completing second or third grade at Rock Point had to go to Chinle (50 miles away) to continue their education, the Chapter (the community level political unit) formed an Education Committee to urge enlargement of the school at Rock

Point. As a result of the Committee's efforts, the school *was* enlarged in 1963-1964. In 1964 the school undertook an intensive school-wide EFL program, one which was eventually adopted by the Navajo Area. In 1967, the local Education Committee chose to put their first meager supplemental funds (Title I) into a modest initial literacy in Navajo activity for six-year-old beginners. Through the committee's continuing efforts, the school was enlarged a second time in 1967-1968. The Tribal Council formally organized Local Navajo Community School Boards in 1969, and in 1971, the Board sought and received Title VII (bilingual education) funding for bilingual education activities.

The following year, the Board obtained its first contract with the Bureau to operate the entire school, and the school is now in its seventh year of contract operation. A basically uneducated, monolingual Navajo School Board manages a combined budget in excess of 1.8 million dollars (FY78), interviews and hires (and fires) employees, and makes all major policy and financial decisions.

## The Educational Program

The school's *basic* education program involves coordinate bilingual instruction: separation of language by speakers. Navajo Language Teachers (NLTs) teach in Navajo; English Language Teachers (ELTs) teach in English. Both NLTs and ELTs plan and teach their own lessons; NLTs *are* teachers, not aides. Overall team planning is done together.

The kindergarten has a team of two NLTs and one ELT. The NLTs teach Navajo reading readiness and arithmetic in Navajo in separate parts of the classroom and, jointly, Navajo social studies. The ELT teaches EFL and arithmetic in English. In each of the next six classrooms, beginner (six-year-olds who have not taken part in, or have not completed, kindergarten) through second grade, there are two-teacher teams, NLTs and ELTs, teaching at opposite ends of the rooms. NLTs teach Navajo reading, arithmetic in Navajo, and Navajo social studies, which involves topics selected by the Board, with heavy concentration on the Navajo clan and kinship systems. The ELTS teach EFL and arithmetic in English. English reading is added in the second grade. Thereafter, children read in *both* languages.

In classroom grades three through six there is a single teacher, an ELT. The classroom ELT teaches reading (in English) and arithmetic (in English). Students leave the room throughout the day in half-class groups for programmed reading, Navajo literacy, and either science in Navajo or Navajo social studies (one semester of each). Health is taught (in English) once a week. (The school has since added junior high grades which were not involved in the study. Bilingual instruction has continued in the junior high.)

The program could be characterized as a maintenance program with a progressive shift towards English. In the kindergarten, about 70 percent of the instruction is in Navajo; in the primary classrooms (beginner through grade two), about 50 percent is in Navajo; in the elementary grades (three through six), about 20 percent is in Navajo; and in the junior high, perhaps 15 percent of the instruction is in Navajo.

The school has attempted to develop an integrated education and student care program with multiple funding sources. The School Board has, in proposals, stated that their goal is the continued development of quality *Navajo* education *through* increased community management and control. Bilingual education is not a component of, or an adjunct to, the education program; bilingual education *is* the education program. The Board has tended to

structure the school toward this end--activities which are not felt to contribute directly to a bilingual curriculum have been modified or eliminated.

## Supporting Features

**Selection, Development, and Training of Teachers.** The School Board has come to see the development of teachers from the community as the only way a rural Navajo community can attract and retain a stable staff. All NLTs are Navajos, most from the Rock Point community. An increasing number of the ELTs are Navajo--roughly, three-quarters by 1978. Most Navajo teachers do not have, but are working toward, degrees. Teachers at Rock Point are carefully selected and go through extensive screening procedures. The School Board interviews job applicants meeting minimal standards. Since local people without degrees or prior training have been hired and are being hired to teach in the bilingual program, an intensive and extensive training program has had to be developed. This program consists of half-year internships, periodic in-service training, on-going demonstration teaching, and formal college courses taught by local as well as university instructors.

The training program for NLTs has concentrated on teacher literacy (teaching prospective teachers to read and write Navajo), methodology for teaching Navajo language arts, and methodology for teaching content subjects in Navajo. The needs of ELTs are different but have also required an intensive training program. The Rock Point administration has assumed that most college trained teachers are not prepared to teach in a situation like Rock Point. Therefore, an in-service program was developed to train both local and college trained ELTs techniques for teaching in a second language situation. The training includes emphasis on TEFL oral language techniques and on TEFL techniques for teaching reading, writing, and content subjects.

The training program that has evolved combines on-site coursework at Rock Point during the school year with on-campus coursework at Northern Arizona University in the summers. By the fall of 1977, 16 people had completed Bachelor of Science degrees (only two or three community people have managed to earn degrees in Education in the conventional manner). Although 12 of these graduates have remained at Rock Point, most have moved into specialist or administrative roles, leaving the school with a majority of nondegreed classroom teachers. It is important then, in reading this study, to remember that the Rock Point results are the work of a largely nondegreed, noncertified, Navajo staff.

**The Structure of the Curriculum.** The program at Rock Point is highly structured in both languages--particularly in English. The English language curriculum is designed to teach English as a foreign or second language. Both structural and situational approaches are used, with emphasis on a structural, sequential approach. English is introduced in small, systematic steps beginning with simpler structures.

Content subject matter is not introduced in English until second grade, and it is limited to the content in the English readers used in the English reading program. The English language curriculum from third through sixth grade is limited to the subject areas of language arts, arithmetic, and some social studies. The emphasis at these levels is still on teaching English as a foreign or second language with somewhat more relaxed TEFL-derived techniques employed in all content areas.

The Navajo language program is also basically highly structured. There were no precedents available at the time for a Navajo language curriculum or learning-to-read materials. There was, and is, a growing body of Navajo

language reading materials by the Bureau, Rough Rock, the Navajo Reading Study, Sanostee, and others, but Rock Point was forced to develop materials to teach initial reading in Navajo and arithmetic in Navajo. The curriculum and materials developed were, of necessity, relatively simple and rather mechanically structured. There were also no precedents for teaching in Navajo or training teachers in Navajo (training tended to focus concretely on how to teach the materials developed or available at Rock Point).

The English language and the Navajo language curricula are coordinated. Concepts taught in Navajo tend to be many of the same concepts that will be needed later in English. The reading systems are similar, using a so-called linguistic approach with both languages. The same arithmetic program is used in both languages in the primary grades. Arithmetic lessons are taught first in Navajo and later are repeated in English. Navajo social studies and science in Navajo, however, are taught only in Navajo.

Behavioral objectives and criterion-referenced testing have been established for both languages, and children are tested regularly to determine if the objectives are being met. Students' and groups' progress is monitored frequently, and the school is viewed as mastery-oriented.

Despite the fact that this monograph depends almost entirely upon standardized achievement test data, the school itself does not rely very heavily on such data. The heart of evaluation activities at the school is a slowly changing body of criterion-referenced objectives for both Navajo and English activities. A Navajo Language Evaluator and an English Language Evaluator (both of whom have other duties as well) administer such tests upon request from classroom teachers. Itinerant Teachers (in both languages) are assigned to work with some of the students who failed or missed a given test.

**Materials Used in the Program.** Most of the materials used in the Rock Point program are either specifically designed for Navajo children or for general EFL. Commercially available materials intended for native English speakers are modified for use with Navajo children. Although the content of the English language readers is not related to Navajo life, the Navajo language reading materials do generally focus on aspects of Navajo life, and the Navajo social studies materials focus on aspects of Navajo culture. Consequently, children are reading about and discussing things in Navajo that are, or should be, familiar.

Teachers are trained to use these materials through intern, in-service, and demonstration activities.

**School Tradition.** A tradition of high expectations has developed at Rock Point: children are *expected* to succeed. The largely Navajo teaching staff refuses to accept the common stereotype that Navajo children are "not interested in learning, passive, nonverbal, silent." Both the teaching and discussion techniques used in Navajo and the TEFL techniques used in English require students to talk, and they are expected to interact verbally in these and other learning activities.

The school feels that this approach reflects the wishes of the community since Rock Point is a community with high academic and behavioral expectations of their children. The community Parent Evaluation Committee tends to be critical of school employees who do not insist on high standards of attentiveness and behavior. Some outsiders have suggested that the school itself has created these expectations; the school, however, tends to understand this as older (more traditional?) Navajo expectations of responsible child behavior transferred from the home to the school setting.

**Leadership of the School.** A key element coordinating all the variables previously mentioned seems to be leadership. A number of the people have been

with the school for 15 years or more. The same is true of the Board, i.e. the current vice president has served for 20 years--since the Board's inception. This degree of continuity and cooperation toward commonly accepted goals is unusual in an area characterized by rather high professional turnover and consequent changes in direction.

## LIMITING FACTORS ON THE STUDY

The environment of most of the students in this study must be described as essentially monolingual-monocultural.[1] Generally, children enter school speaking only Navajo and have lived primarily in the contemporary Navajo cultural environment. This situation must be taken into consideration when interpreting the results that follow because they may have limited application to children living in other language and culture situations.

The EFL direct method implies that the EFL oral language program and the reading program are coordinated and make use of similar language structure. The programs of the Navajo Area schools in this study differ in the degree of coordination of EFL oral language and reading as well as the degree to which these curricula are followed. It is not possible to claim that every classroom used a similarly coordinated EFL language and reading program.

Bilingual education is a total curricular approach to providing a learning environment for children who are bilingual or who must become bilingual. Many children enter school as monolingual non-English speakers, and it is the school's responsibility to help these children become bilingual. This monograph examines only some of the cognitive aspects of these programs. Although cognitive subjects are essential curriculum components, other aspects of bilingual education must be investigated before the total effects of bilingual education can be assessed.

A random sample of schools or students was not possible for this study. All schools were selected according to curricular criteria. Only one school had developed a bilingual program to the extent that children had become proficient readers in Navajo before beginning English reading; thus, the bilingual group was limited to that school. The Area sample schools were limited to those schools that had established EFL direct method (NALAP, CITE, or other TESL curricula) programs. Also, the bilingual sample size was relatively small at some grade levels (e.g. the smallest sixth grade sample analyzed contained 21 students). Although this sample size was small, it was adequate for comparing means with a T-Test (McCall, 1975).

The populations of the Area sample schools were not completely consistent. Three of the schools, which had their own primary grade program, also received students from small primary grade "feeder" schools at the third and fourth grade levels. Although the Area Education Office recommended that all Area schools use either the CITE or NALAP materials,[2] the extent of implementation and the quality of instruction may have varied from school to school, and many of the transfer students above the third grade level may have received somewhat different instruction. This may have had a negative effect on the three schools' student achievement scores and affected the overall scores of the control groups at the intermediate grade levels.

Theoretically, there are as many approaches to reading in Navajo as there are in any other language. Since only one bilingual school was involved, this study is limited to that one method--what might be described as a linguistic method--of introducing initial reading in Navajo. In addition, bilingual education for Navajo children is a recent innovation, with the earliest *initial* literacy in Navajo programs for Navajo children dating back to 1967. At that time

there were less than 25 texts in Navajo and no children's materials for learning to read in Navajo. Even recently there were fewer than 150 texts in Navajo and only one set of fully developed initial reading materials. These conditions must be taken into consideration with the study.

Finally, bilingual education has implications beyond the classroom. Spolsky has pointed out that bilingual education is influenced not only by the educational and linguistic aspects of the situation but also by some of the sociological, psychological, economic, political, and religious aspects of the situation (Spolsky et al., 1974). The decision to implement bilingual instruction must be made after considering all major aspects of bilingual education. Although academic achievement is only one of the implications of such a decision, this study is limited to the classroom and to academic achievement.

## NOTES

1. Of course, such terminology is relative. There is no doubt that Navajo schoolchildren today are much more influenced by Anglo culture (and the English language) than were students of 10 or 20 years ago. Even so, there is a much higher degree of "language insulation" and cultural self-sufficiency than most American bilingual educators, working with urban Chicano students, know.
2. Ernest Magnuson, personal interview, March 21, 1977.

# The Study

## THE DESIGN

The focus of the study was on the use of Navajo as a medium of instruction in the classroom. Using a comparative design, we examined the effects of introducing reading in Navajo on English language reading achievement, the effects of teaching basic arithmetic concepts in Navajo on English language arithmetic achievement, and the effects of reduced instructional time in English on overall EFL achievement.

Seven BIA schools made up the EFL direct method groups, or Area sample. One group of five schools was used for the Stanford Achievement Test (SAT) comparisons and another group of five schools was used for the Metropolitan Achievement Test (MAT) comparisons; three schools were in both groups. The schools were considered to be among the better Navajo Area schools, and they were selected because (a) upon entering these schools, the children had similar linguistic backgrounds to the Rock Point children when entering school; (b) they had well established EFL programs; (c) they had at least two instructors in each classroom from kindergarten through second grade; and (d) they had at least one instructor per classroom with native competency in Navajo.

Reading was most extensively examined. Children were tested mid-year (February) in grades two through six with the Stanford Achievement Test. The students in the Area sample group were tested once in 1975. The Rock Point students were tested in 1975, 1976, and 1977. Each year's Rock Point mean scores were compared to those of the Area sample scores. In 1976, both groups were tested with the Metropolitan Achievement Test.

The SAT was also used in the arithmetic achievement study, and arithmetic subtests were administered in 1975 to all students in both groups, second through sixth grade. The data involved in both the reading and arithmetic studies were statistically analyzed with a T-test of differences in group means. The level of significance was established at .05.

The study of English proficiency involved a comparison of Rock Point mean scores and the Area mean scores (for all students tested in the Navajo Area). The test administered was developed by Eugene Brière for the Bureau and is referred to by the acronym TOPESL--*T*est of *P*roficiency in *E*nglish as a *S*econd *L*anguage. The TOPESL test was designed to measure English language competency of American Indian children who are non-native speakers of English. The test was administered in all Area schools in grades four through six in 1974. Rock Point administered the test in 1975 and again in 1976. The Rock Point results for each year were compared to the 1974 BIA data. The data are presented for visual analysis; no statistical analysis was performed.

## BASIC DATA

This section presents the study's basic data--a set of comparisons of scores on the standardized achievement tests. Statistical analyses of the reading scores are to be found in Rosier (1977). Three sets of data are presented:

(1) A comparison of Navajo Area sample mean scores with the grand mean scores of the bilingual students for Total Reading and for the Word Study Skills and the Reading Comprehension subtests (SAT) is shown for each grade level two through six. ("Grand mean score" refers to an average of accumulated Rock Point student achievement scores from 1975-1977 at each grade level.)

(2) A similar comparison of mean scores for Total Arithmetic (SAT) is given for each grade level two through five. Mean scores on the Arithmetic Concepts and the Arithmetic Applications subtests for the EFL-only students and for the bilingual students are compared and some differences are noted.

(3) A comparison of the EFL-only mean scores with the bilingual grand mean scores for the English Structure and the Listening Comprehension subtests of the TOPESL are given for each grade level four through six.

### Reading Achievement

Charts 1, 2, and 3 (see pages 31-32) depict the results of the reading comparisons. The three years' data collected at Rock Point have been averaged and are compared to the 1975 Area sample student achievement scores. The Total Reading chart (Chart 1) displays the overall pattern of the data.

According to these comparisons, the Rock Point students scored about two grade-level-equivalent months[1] below the Area sample students at the second grade level; statistically this difference was not significant. At the third and fourth grade levels, the Rock Point students generally scored somewhat higher than the Area sample students in the same grades. Many of the comparisons were significant at the fourth grade level, and the differences at the fifth grade level were significant in all comparisons--the Rock Point students scored 1.6 grade-level-equivalent years higher than the Area sample students. Their average score of 5.1 was approximately four months below the national norm. At sixth grade level all comparisons again were significant--the Rock Point sixth graders scored 2.0 years higher than the Area sample students, and their average score of 6.2 was only three months below the national norm.

The Word Study Skills chart (Chart 2) and Reading Comprehension chart (Chart 3) display the data for these subtests. Their patterns follow that of Chart 1, with students at Rock Point scoring near grade level on these subskills at the fifth and sixth grade levels. The MAT test results followed the same pattern, but both groups scored lower on the MAT than on the SAT.

The differences between bilingual and EFL-only means for the two subtests might be noted. The data is drawn from Charts 2 and 3. The differences for the Reading Comprehension subtest are not as great as those for the Word Study Skills subtest.

The Paragraph Meaning or Reading Comprehension subtests require students to select one of four given words to fill a given blank in a single- or multiple-paragraph text. Students may draw upon their knowledge of word meaning, word form, agreement, sentence grammar, story sense, and cultural background in selecting an answer.

The Word Study Skills subtest requires students to select words with the same sound in a given position despite different spellings. Table 2 shows a difference of only 1.73 grade-equivalent school years between Area sample

second and sixth graders, and many Area teachers have concluded that word study skills simply cannot be taught.

Table 2.

| Word Study Skills | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| Rock Point | 2.12 | 2.46 | 3.27 | 4.86 | 6.30 |
| Area Sample | 2.43 | 2.24 | 2.55 | 3.05 | 4.16 |
| Difference | -.31 | +.22 | +.72 | +1.81 | +2.24 |
| **Reading Comprehension** | **2** | **3** | **4** | **5** | **6** |
| Rock Point | 1.87 | 2.42 | 3.10 | 5.15 | 6.07 |
| Area Sample | 2.05 | 2.25 | 2.78 | 3.78 | 4.54 |
| Difference | -.18 | +.17 | +.32 | +1.37 | +1.53 |

The Rock Point results suggest otherwise: there is a difference of 4.18 grade-equivalent school years between second and sixth graders. We would suggest that Rock Point students, having learned to read in a more phonemic orthography (Navajo) and having learned to read English at first as if it had a phonemic orthography, are better able to handle the apparent lack of fit of a more morphophonemic orthography (English).

### Arithmetic Achievement

Chart 4 (see page 32) depicts the comparison of total arithmetic achievement on SAT. At the second and third grade levels, the bilingual students scored lower than the EFL-only students. At the fourth grade, the bilingual students surpassed the achievement of the EFL-only students. The difference at this level was nine months, which was significant on the T-test analysis. At the fifth grade level the difference in groups was 1.2 years; again this difference was significant. No comparison is shown for the sixth grade level because only six students were enrolled at that level at Rock Point in 1975. MAT test results in 1976 and 1977 show that Rock Point students scored as high as, or higher than, Navajo Area mean scores from fifth grade on in general arithmetic achievement.

In general, Navajo students tend to score highest on the Arithmetic Computation subtest, which is less language-bound and can be mastered through rote learning. Arithmetic Application is the subtest on which Navajo students tend to score lowest and which usually involves language and problem solving strategies. Table 3 displays within-group comparisons of student achievement on Arithmetic Computation and Arithmetic Application subtests. The scores of the EFL-only students followed the general pattern of Navajo student achievement. The mean scores in computation were approximately four to five months higher than the mean scores in application at the third and fourth grade levels. By the fifth and sixth grade levels the differences in the scores for computation and application were 1.2 and 1.0 years, respectively. Computation was the arithmetic subtest on which these students consistently scored the highest at each grade level.

The pattern of student achievement in the bilingual school was different.

Student mean scores at the third and fourth grade levels showed that mean scores for computation were six to seven months higher than the mean scores for application, but at the fifth and sixth grade levels, the trend was reversed: mean scores in application were higher. By fifth grade, Arithmetic Application became the arithmetic subtest on which the students at Rock Point scored highest.

Table 3. *A Comparison of Area Sample (EFL Direct Method) Student Mean Scores, 1975, on the Computation and the Application Subtests, Stanford Achievement Test. A Comparison of Rock Point (Bilingual) Student Mean Scores, Three-Year Accumulation 1975-77, on the Computation and the Application Subtests, Stanford Achievement Test.*

| | CONTROL SCHOOLS Mean Scores | | ROCK POINT Mean Scores | |
|---|---|---|---|---|
| Grade | Computation | Application | Computation | Application |
| 3 | 2.94 | 2.30 | 2.87 | 2.06 |
| 4 | 3.22 | 2.81 | 3.70 | 3.04 |
| 5 | 4.40 | 3.42 | 4.86 | 5.12 |
| 6 | 4.96 | 3.98 | 6.30 | 6.85 |

## EFL Proficiency

The results of the TOPESL testing appear in Charts 5 and 6 (see page 33). The Rock Point results for 1975 and 1976 have been averaged and compared to both the Navajo Area and the Chinle Agency[2] 1974 results.

The English Structure subtest results (Chart 5) showed that Rock Point students at the fourth grade level scored higher than Agency and Area fifth grade students; Rock Point fifth grade students scored higher than Agency and Area sixth grade students. At the sixth grade level, Rock Point students scored over 90 percent and were within 10 percentage points of native English speakers. The results on the Listening Comprehension subtest (Chart 6) were similar. Rock Point fourth graders scored near the Navajo Area mean percentage score for the sixth grade, and they did score as high as the Agency sixth graders. Again, the Rock Point sixth grade students scored within 10 percentage points of native speakers.

The TOPESL test was designed so that native speakers at a comparable age or grade scored 100 percent. Consequently, the top end of the test is very difficult to obtain, i.e. the closer a student scores to 100 percent, the more difficult any additional gain becomes. A detailed display and description of the data appear in the appendices. All T-test comparisons and levels of significance will be found there.

## Summary of Basic Data

The bilingual grand mean scores for Total Reading (SAT), although lower at the second grade, were higher than the EFL-only mean scores for all grades three through six. The same pattern characterized mean scores on both the Word Study Skills and the Reading Comprehension subtests. Despite not having begun reading in English until mid-second grade, the bilingual

students did better on tests of reading in English than did EFL-only students who had begun reading in English as much as a year-and-a-half earlier. The EFL-only means for the Word Study Skills subtest show little "progress" from grade two through six. The bilingual means, however, show more than usual progress; bilingual sixth graders averaged within two months of the national average.

The bilingual grand mean scores for Total Arithmetic, although lower at the second and third grades, were higher than the EFL-only mean scores for grades four and five. The bilingual students, who had studied arithmetic in Navajo and English through the second grade, did better on tests of arithmetic in or through English at the higher grades than did EFL-only students who had studied arithmetic in English only since entering school. Because of Rock Point's insistence on mastery of criterion-referenced tests, the bilingual students had moved through elementary arithmetic materials more slowly, but more thoroughly, than had most Navajo Area students, usually not completing "third grade" materials until the fifth or even the sixth grade. Under these circumstances, the bilingual scores are somewhat more impressive than they seem at first.

The EFL-only means for the Arithmetic Computation and Arithmetic Application subtests fell in the usual Navajo Area pattern with application means tending to fall progressively further behind computation means at each higher grade. The bilingual means presented a different pattern: application means tended to more closely approximate computation means at each higher grade until, at the fifth grade, the application means actually exceded the computation means. The bilingual students not only did better on the less English-language-bound Arithmetic Computation subtest, but they also did considerably better on the more English-language-bound Arithmetic Application subtest.

The bilingual grand mean scores for the English Structure and the Listening Comprehension subtests of the TOPESL were markedly higher than those of the EFL-only mean scores at all grades tested. Thus the bilingual students, who had spent considerably less time in instruction through English, still did better on tests of English as a Foreign Language ability than did Navajo Area students in good English-only programs.

## SUPPORTIVE DATA

The following data support the basic data just presented, and these displays are intended to counter some of the more obvious objections that might be raised. The data are a set of mean scores, with no statistical analysis provided; four sets are presented:

(1) A comparison of the Navajo Area sample mean scores and the entire Navajo Area mean scores for each grade level two through six is displayed. This comparison shows the relation of the sample group mean scores to that of Navajo Area students as a whole.

(2) A comparison of Rock Point achievement and each of the sample schools at grade levels two through six is presented. This display shows how Rock Point compared with each school, how the sample schools compared with each other, and the range in the sample group mean scores.

(3) A comparison of fourth grade student achievement in 1975 demonstrates the difference in achievement of students who had continuous bilingual instruction and those who had interrupted bilingual instruction.

(4) A comparison of Rock Point student achievement in 1970 and in 1975-77 demonstrates the difference in achievement before and after Navajo language

instruction was added. The primary differences in the educational programs of these two groups of students were the extent and continuity of bilingual instruction.

### Navajo Area Sample Schools--Navajo Area Schools

The authors, with the assistance of the Navajo Area Education Office, selected a group of Navajo Area schools which had well-established EFL direct method programs. These programs, generally, were implemented at the primary level. It is our opinion that the sample group represented the better, if not the best, Navajo Area schools. In order to substantiate this claim, data were requested from the Area Education Office that would allow a comparison of the sample means and the Navajo Area means. Area Education was very cooperative, but they could only provide the data they themselves had available.

During school year 1974-75 Navajo Area did not conduct an Area-wide standardized achievement testing program; therefore, it was not possible to make comparisons for that year. During school year 1975-76 Navajo Area reintroduced Area-wide testing but decided to use the Metropolitan Achievement Test (MAT) rather than the Stanford Achievement Test (SAT) which had been used until 1972. Therefore, any comparison of the sample group and Navajo Area has to be made with MAT data and at least one or two years later than the basic data used in this study. We believe that there were no dramatic changes in these years, that the Area sample schools remained among the best of the Area schools.

The Navajo Area Special Projects office provided Area-wide mean scores of MAT tests administered in the fall of 1976; however, they were able to locate only 1975 data for individual schools and this for only three of the five Area sample schools. (The Area sample of five schools were the schools tested in 1975 with the Stanford Achievement Test.) The school the authors considered to have the best primary program was one of the two for which no scores were available. Consequently, Table 4 is a comparison of the 1975 average mean scores of three of the five sample schools with the 1976 Navajo Area mean scores.

Table 4. *A Comparison of Navajo Area (as a Whole) Student Mean Scores 1976 with the Area Sample Student Mean Scores 1975 on the Total Reading and Total Arithmetic Components, Metropolitan Achievement Test.*

| | READING | | ARITHMETIC | |
|---|---|---|---|---|
| Grade Level | Navajo Area | Sample | Navajo Area | Sample |
| 2 | 1.5 | 2.0 | 1.4 | 1.7 |
| 3 | 2.1 | 2.3 | 2.2 | 2.5 |
| 4 | 2.4 | 2.5 | 3.0 | 2.9 |
| 5 | 2.7 | 2.7 | 3.4 | 3.4 |
| 6 | 3.5 | 3.6 | 4.2 | 4.3 |

Table 4 shows that the Area sample schools scored as high as, or higher than, the Navajo Area mean score at every grade level, except one. At the fourth

grade level, the Navajo Area mean score in total arithmetic was one month higher than that of the sample schools. The greatest differences were at the second and third grade levels, where sample group scores were from two to five months higher in reading and arithmetic.

The slight superiority of the sample schools, more marked in the lower grades, seems to support the assumption that the sample group represents the better, if not the best, Navajo Area schools. While the data here are scant, the relative "failure" of the Area sample to maintain this advantage in the upper-elementary grades should be noted. This may be due, in part, to the relatively recent implementation of intensive EFL programs, and EFL-trained students may not have reached the fourth grade. It is more likely due to the scope of the EFL programs and materials: Area teachers tend to see EFL as a primary grade program.

### Rock Point--Navajo Area Sample Schools

Charts 7 through 11 (see pages 34-36) display comparisons of Rock Point student achievement and the student achievement of each of the schools in the Area sample. Grade level mean scores for SAT Total Reading are compared at each grade level from second through sixth grade. The Rock Point mean scores are grand mean scores for 1975, 1976, and 1977. These grand mean scores are compared to the 1975 mean scores of each of the Area sample schools. The one exception is at the fourth grade level. The sample schools' mean scores are composed of an average of the 1975 actual student achievement scores and 1976 and 1977 computer-created scores. The computer-created scores were used in 1976 and 1977 as the standard of comparison with which the Rock Point student achievement was compared. (See Appendix B for a more detailed explanation.) The national norms for each grade level are also presented. This allows the reader to compare all the mean scores to national norms.

Chart 7 shows that at the second grade level three of the sample schools' means were higher in Total Reading than were Rock Point's mean scores. One school's mean score was lower. All schools' mean scores were below the appropriate national norms. Chart 8 displays a comparison of third grade achievement in Total Reading. Rock Point mean scores were as high as or higher than those of all sample schools but one, which had a mean three months higher than Rock Point's. Chart 9 exhibits a comparison of Total Reading achievement at the fourth grade level. Rock Point students' mean score was higher than the mean scores of all of the sample schools. The range in difference was from one to seven months.

Charts 10 and 11 display comparisons of Total Reading achievement at the fifth and sixth grade levels. The Rock Point mean score was higher than that of all the Area sample schools at both levels. The range at the fifth grade level was from 1.4 to 2.1 grade-level-equivalent years. The range at the sixth grade level was 1.4 to 2.6 grade-level-equivalent years. At the fifth grade level, the Rock Point mean score was five months below the national norm. At the sixth grade level, Rock Point was within three months of the national norm.

The data presented in Charts 7 through 11 demonstrate that there was a wide range in the sample schools' achievement, particularly at the fifth and sixth grade levels. The data also show that at the fifth and sixth grade levels the Rock Point mean scores were higher, by at least 1.4 grade-level-equivalent years, than any of the sample schools' mean scores. The combination of scores from different schools in the Area sample has not been used

to hide schools with scores better than Rock Point's in the upper elementary grades.

### Rock Point Continuous Bilingual Instruction--Rock Point Interrupted Bilingual Instruction

In 1975, the Rock Point fourth grade was composed of students who had received continuous bilingual instruction and of students whose bilingual instruction had been interrupted. The former group had begun school receiving initial literacy, arithmetic, and content subjects instruction in Navajo. They continued to receive bilingual instruction throughout their elementary schooling. The latter group had also entered school in a bilingual classroom. They received reading readiness and content subject instruction in Navajo, but the following year they entered into a monolingual, EFL direct method curriculum. From the third grade level on, these students received science, social studies, and upper-grade Navajo literacy instruction in Navajo. These children had entered school *before* Rock Point received its first Title VII grant; previously, Rock Point (receiving only Title I funds) had operated only a limited first year bilingual program.

Both groups were tested in May, 1975 on the 1973 edition of the SAT Total Reading subtests, with 20 students in each testing group. Table 5 displays the results of the comparison. Students who had received continuous bilingual instruction scored approximately eight months higher than their classmates who had not. In some respects this comparison may provide the most meaningful information for evaluating the effects of bilingual education since most aspects of the instructional situation were the same. The major differences between the two groups were the extent and continuity of Navajo language instruction in a coordinate bilingual education program. (It should be noted, however, that the students whose bilingual education had been interrupted seemed to be older, academically slower children.) Although the preceding data must be used with caution, the test results seem to indicate that continuous bilingual instruction may have provided a more effective learning environment.

Table 5. *A Comparison of the Mean Scores of Rock Point Fourth Grade Students Who Had Continuous Bilingual Instruction with the Mean Scores of Rock Point Fourth Grade Students Who Had Interrupted Bilingual Instruction on the Total Reading Component, SAT, in 1975.*

| | TYPE OF INSTRUCTION | |
|---|---|---|
| Group | Continuous Bilingual | Interrupted Bilingual |
| National Norm | 4.8 | 4.8 |
| Rock Point Fourth Grade | 4.2 | 3.4 |
| Relationship to the National Norm | .6 below | 1.4 below |

### Rock Point Bilingual (1975-1977)--Rock Point EFL-Only (1970)

Chart 12 (see page 36) shows a comparison of Rock Point student achievement in 1970 with the grand mean achievement of Rock Point students for

1975, 1976, and 1977. The 1970 scores represent the achievement of students taught in English only. The 1963-67 instructional program had been an intensive EFL-only program. Only the second grade students could have participated in bilingual instruction. In 1970, Navajo Area tested only the second, fourth, and sixth grade levels, using the 1964 edition of the SAT. (Rock Point was, at that time, still a Bureau-operated school.) The grade-level-equivalent mean scores for each of the grades tested have been converted to grade-level-equivalent scores for the 1973 edition of the SAT using a conversion table provided by the publishers (Stanford Research Report, 1973:1-14). Since the two editions of the SAT differ significantly, only reading comprehension subtests are compared. The 1964 edition Paragraph Meaning subtest means are compared to the 1973 edition Reading Comprehension subtest means. The Navajo Area mean scores (norms) which had been established for the 1964 SAT edition are also presented in Chart 12; these have been converted to 1973 grade-level-equivalents to allow comparison.

Chart 12 shows that the EFL-only students (1970) scored approximately .8 years higher at the fourth grade level than the bilingual students (1975-1977), but at the sixth grade level, the bilingual students (1975-1977) were .7 years higher than were the EFL-only students (1970). The sixth grade comparison is most significant because Rock Point, since the mid-1960s, had consistently scored higher than the Navajo Area norms at this level. The seven-month increase placed Rock Point students within four months of the national norm. Because the norming group used to develop the conversion table was very small--less than 200 students per grade level--and because the publishers indicate that there are a number of differences between the two tests (Stanford Research Reports, 1973), this comparison must be used with caution.

Corroboratory information can be obtained by examining the differences in mean grade-level-equivalent scores between the achievement of Rock Point students and Area student achievement on the same edition of the SAT. Table 6 (see page 24) is a display of such mean score difference. Comparison A shows the difference in mean scores at the sixth grade level between the Navajo Area norm and Rock Point in 1970. This is a comparison of the achievement of students in an intense EFL-only program (Rock Point 1970) with students in mixed EFL-only and non-EFL programs (Navajo Area). The difference in the mean scores was seven months. The test instrument for both groups was the 1964 edition of the SAT.

Comparison B displays the mean score difference between the three-year Rock Point grand mean (1975-1977) for the sixth grade and the sixth grade mean of the Navajo Area sample (1975), the data used in this study. All students were tested on the 1973 edition of the SAT. The difference in mean scores was 1.6 years. Although the Rock Point student achievement was greater in both comparisons, the difference in comparison B is nine months greater than in comparison A. The introduction of bilingual instruction seems to be *an* important, if not *the* important, factor in the increased difference in achievement between Rock Point students and Navajo Area students. The comparisons displayed in Chart 12 and Table 6 have an inherent weakness, being based on scores from two different editions of the SAT. It would appear, however, that the reading in English achievement of Rock Point students has *increased* since the introduction of bilingual instruction.

Here two things should be noted. One is that the 1970 Rock Point results involved the efforts of a degreed, largely non-Navajo staff; no NLT had a degree and there were no Navajo ELTs. The 1975-1977 results involved the efforts of a largely (half to three-quarters) nondegreed staff, of whom half

Table 6. *A Comparison of Mean Score Difference at Sixth Grade: (A) A Comparison of the Area (EFL Direct Method or No Method) Sixth Grade Student Mean Score 1970 with the Rock Point (EFL Direct Method) Sixth Grade Student Mean Score on the Paragraph Meaning Subtest, Stanford Achievement Test (1964 Edition). (B) A Comparison of the Area Sample (EFL Direct Method) Sixth Grade Student Mean Score 1975 with the Rock Point (Bilingual) Sixth Grade Student Mean Score on the Reading Comprehension Subtest, Stanford Achievement Test (1973 Edition).*

| COMPARISON A SAT PARAGRAPH MEANING (1970) | | | COMPARISON B SAT READING COMPREHENSION (1975-1976-1977) | | |
|---|---|---|---|---|---|
| Area Norm | Rock Point | Difference | Area Sample | Rock Point | Difference |
| 4.1 | 4.8 | .7 | 4.5 | 6.1 | 1.6 |

to three-quarters were Navajo; by 1977, half of the ELTs were Navajo. The teaching staff in 1975-1977 consisted of a majority of teachers for whom English was their second language and who were working toward or had recently obtained a degree. They were formally less well prepared than were Rock Point teachers in 1970 or Navajo Area teachers in 1975-1977, yet they seem to have achieved better results as indicated by student performance on standardized achievement tests.

We do not have data to substantiate our distinct impression that, probably due to continued drift of the more acculturated (English speaking) students from Bureau to public schools, Navajo Area means have been falling in recent years. If this should be the case, the apparent rise in Rock Point scores for the sixth grade is even more impressive than it would at first seem. While none of the comparisons in this section is in itself conclusive, taken together they indicate that a change in the languages of instruction has accompanied, and probably caused, an improvement in already high (for Navajo Area) test mean scores.

## PATTERNING OF DATA

This section presents several analyses of patterning perceived in the data presented in the preceding sections. The data are derived almost entirely from the mean scores presented as basic data; no additional statistical analyses were performed.

(1) Data is presented to show that Rock Point grand means tend to diverge further from Navajo Area means at each higher grade level.

(2) Data is presented to show that while Navajo Area means tend to diverge further from national norms at each higher grade level, Rock Point grand means tend to converge, after the fourth grade, toward national norms at each higher grade.

(3) Data is presented to show that, assuming the one-time data available would be comparable to longitudinal data not available, the Rock Point students tend to be making up to twice the amount of progress between grade levels as are Navajo Area sample students.

(4) Data is presented to show that, given the same assumptions as above, Area sample students are progressing at about half the national average rate of progress, while Rock Point students are progressing at about the national average rate and may be exceeding that rate at the fifth and sixth grades.

### Divergence

The Rock Point grand means tend to diverge further from the Navajo Area means at each higher grade. The following data are drawn from Charts 1 and 4.

Table 7.

| Total Reading | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| Rock Point | 1.94 | 2.39 | 3.13 | 5.05 | 6.20 |
| Area Sample | 2.16 | 2.29 | 2.67 | 3.41 | 4.16 |
| Difference | -.22 | +.10 | +.46 | +1.64 | +2.04 |
| **Total Arithmetic** | **2** | **3** | **4** | **5** | **6** |
| Rock Point | 2.11 | 2.37 | 3.29 | 5.02 | |
| Area Sample | 2.44 | 2.49 | 2.35 | 3.84 | |
| Difference | -.33 | -.12 | +.84 | +1.18 | |

Noting this, Rock Point is inclined to ascribe these differences to the efforts of initial and continuing instruction in Navajo and to say that these effects are cumulative. A devil's advocate might point out that the really significant differences occur at just those grades where the amount of time for instruction through Navajo is reduced to less than half, i.e. instruction through Navajo might be holding the students back. Data cited earlier showed that Rock Point fourth grade students who had received uninterrupted bilingual instruction had done better than those who had received interrupted bilingual instruction and that Rock Point sixth grade students who had received bilingual instruction had done better than had Rock Point sixth grade students who had received EFL-only instruction only five, six, or seven years earlier. This strongly suggests that the use of Navajo as a language of instruction caused, at least in part, higher academic achievement as measured on English language standardized achievement tests.

### Convergence

Another aspect of the same patterning is the degree to which mean scores approximate national norms. On both the Total Reading and the Total Arithmetic subtests, Navajo Area sample means tend to diverge further from the national norms at each higher grade level.[3] Rock Point grand means, however, tend to diverge until the fourth grade level; thereafter, they tend to converge towards national norms. The data again are drawn from Charts 1 and 4.

Table 8.

| Total Reading | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| National Norms | 2.5 | 3.5 | 4.5 | 5.5 | 6.5 |
| Area Sample | 2.16 | 2.29 | 2.67 | 3.41 | 4.16 |
| Differences | -.34 | -1.21 | -1.83 | -2.09 | -2.34 |
| National Norms | 2.5 | 3.5 | 4.5 | 5.5 | 6.5 |
| Rock Point | 1.94 | 2.39 | 3.13 | 5.05 | 6.20 |
| Differences | -.56 | -1.11 | -1.37 | -.45 | -.30 |
| **Total Arithmetic** | **2** | **3** | **4** | **5** | **6** |
| National Norms | 2.5 | 3.5 | 4.5 | 5.5 | 6.5 |
| Area Sample | 2.44 | 2.49 | 2.35 | 3.84 | |
| Differences | -.06 | -1.01 | -2.15 | -1.66 | |
| National Norms | 2.5 | 3.5 | 4.5 | 5.5 | 6.5 |
| Rock Point | 2.11 | 2.37 | 3.29 | 5.02 | |
| Differences | -.39 | -1.13 | -1.21 | -.48 | |

## Progress

Longitudinal data are not available for the Navajo Area sample schools. If one assumes, however, that most students remain in the same school from kindergarten through sixth grade and are promoted to the next grade each year, and that mean scores at each grade have tended to be more or less constant for the last five years or so, then one can treat the one-time data given earlier as multi-year data. (E.g. if last year's third graders are this year's fourth graders, and this year's third and fourth grade means are each comparable to last year's means, then the difference between this year's third and fourth grade means is roughly the same as the amount of progress made by this year's fourth graders since last year.) The data in Table 9 (see page 27) are drawn from Charts 1 and 4.

There seems to be for both groups (with the exception of the anomalous fourth grade Area sample arithmetic means shown in Table 9) an acceleration of progress from the second through the sixth grade; this seems to be more marked between the fourth and fifth grade for both Rock Point students and for Area sample. (As noted earlier (page 21), we feel the fourth grade scores may be suspect.) The progress for Rock Point students is markedly higher--at least double that of Area sample students for all comparisons except fifth grade arithmetic.

Initial efforts to develop longitudinal progress data for students at Rock Point between school years 1977 and 1978 have given us indications of some of the inadequacies of such growth comparisons. Still, such comparisons are indicative of progress patterns. Until or unless we are able to develop longitudinal data for a number of schools, controlling those variables noted earlier, such comparisons will be only that: indicative.

## Rate of Progress

A "rate of progress" is a hypothetical construct that may be of some utility in comparing programs, but it is dependent upon the assumptions noted

Table 9.

| Total Reading | 3 | 4 | 5 | 6 |
|---|---|---|---|---|
| Area Grade N | 2.29 | 2.67 | 3.41 | 4.16 |
| Area Grade N-1 | 2.16 | 2.29 | 2.67 | 3.41 |
| Differences | +.13 | +.38 | +.54 | +.75 |
| RP Grade N | 2.39 | 3.13 | 5.05 | 6.20 |
| RP Grade N-1 | 1.94 | 2.39 | 3.13 | 4.16 |
| Differences | +.45 | +.74 | +1.92 | +2.04 |
| **Total Arithmetic** | | | | |
| Area Grade N | 2.49 | 2.35 | 3.84 | |
| Area Grade N-1 | 2.44 | 2.49 | 2.35 | 3.84 |
| Differences | +.05 | -.14 | +1.49 | |
| RP Grade N | 2.37 | 3.29 | 5.02 | |
| RP Grade N-1 | 2.11 | 2.37 | 3.29 | 5.02 |
| Differences | +.26 | +.88 | +1.73 | |

previously. An assumption implicit in the use of national norms for standardized achievement tests is that the "average" student makes 1.0 grade-equivalent school years (or 10 grade-equivalent school months) progress during 10 months in school. The national average rate of progress--10 months progress in 10 months time--would be 100 percent. Progress at other schools may be compared to this by taking the difference between the highest grade's and the lowest grade's means and dividing this by the number of school months between the two grades (as if this were longitudinal data). The data also require the assumptions outlined in the previous section.

Table 10.

| | | | MONTHS | | |
|---|---|---|---|---|---|
| Reading | 6th | 2nd | Difference | In School | Rate |
| Area Sample | 4.16 | 2.16 | 20.0 mos | 40 mos | 50% |
| Rock Point | 6.20 | 1.94 | 42.6 mos | 40 mos | 107% |
| | | | MONTHS | | |
| Arithmetic | 5th | 2nd | Difference | In School | Rate |
| Area Sample | 3.84 | 2.44 | 14.0 mos | 30 mos | 47% |
| Rock Point | 5.02 | 2.11 | 29.1 mos | 30 mos | 97% |

The data, drawn from Charts 1 and 4, suggest that the Area *sample* students, who are doing somewhat better than Area-as-a-whole students, are progressing at about half the national average rate; Rock Point students, well behind national norms at the second grade and still somewhat behind the national norms at the fifth or sixth grade, are progressing at rates slightly

above or below the national average. Even this is misleading. Progress, as inferred from Charts 1 and 4, is not uniform; it seems to accelerate between the fourth and fifth grades. The rate of progress, if computed for Total Reading at Rock Point between the fourth and sixth grades, would be 153 percent.

It is not known if rates of progress in excess of 100 percent can be maintained in junior high and beyond. If we see such mean scores as relatively indicative of current academic ability and of future academic potential, and if we accept the validity of the Bereiter-Engelmann dilemma,[4] then we *must* find ways to try to see that such rates of progress *do* continue.

## CONCLUSIONS

We feel we can draw the following conclusions from the data presented in preceding sections.

- Navajo students who had initially been taught to read in Navajo seem, by the third grade, to read better in English than Navajo students who had been taught to read in English only and had been reading in English for longer lengths of time.
- Navajo students had the most difficulty with the Word Study Skills reading subtest. Interestingly enough, the difference in favor of the students who had initially learned to read in Navajo over the students who had learned to read only in English was even more marked for Word Study Skills than for Reading Comprehension.
- Navajo students who had initially been taught arithmetic in Navajo seem, by the fourth grade, to do better in arithmetic than students who had been taught arithmetic only in English--despite the slower pace of arithmetic instruction in the bilingual program.
- Navajo students who had been taught in both Navajo and English seem to do better in English (as a foreign or second language) than Navajo students who had been taught only in English. This is despite the fact that the bilingual students had been exposed to less instruction through English per day and had had cumulatively less exposure to instruction through English during their school careers.
- It would appear, contrary to the findings of other studies, that ability in English (as a foreign or second language) is not necessarily a simple function of the length or amount of in-school exposure to English.
- Similar patterns in the results of reading, arithmetic, and EFL tests strongly suggest that the results of initial instruction in Navajo may be cumulative: at each grade above the second or third, the bilingual students' scores diverge further from those of the EFL direct method students and converge closer toward national norms.
- Although there must be instances--perhaps temporary--of negative transfer from Navajo learning to English learning, these may be more than offset by positive transfer from academic learning through Navajo to academic learning through English.
- In short, under the circumstances given, a good bilingual program showed demonstrably better results than did good EFL direct method programs in relatively comparable schools.

### The Cumulative Effect

One cannot prove that the incorporation of Navajo language instruction into the Rock Point program caused these results. We must admit that the use of

the Navajo language as a means of academic instruction is part of a mix that includes, among other things, increased community control, increased parental involvement, increased number of Navajo and community teachers, intensive EFL activities, on-going evaluation, and intensive and extensive NLT and ELT training.

We can only say that whatever is happening at Rock Point, the effects seem to be cumulative. An evaluation of the Rock Point program after the first five years of operation might have shown that Rock Point third and fourth graders were averaging little better than Navajo Area third and fourth graders. It was only when those Rock Point students who as kindergarteners had learned to read in Navajo began to reach the fifth and sixth grade that dramatic differences become apparent. This finding alone, we suggest, has important implications for the funding and evaluation of Indian bilingual programs.

In *Bilingual Education*, Joshua Fishman writes:

> . . . on the whole, bilingual education is too frail a device, in and of itself, to significantly alter the learning experiences of the minority-mother-tongue-poor in general or their majority-language-learning-success in particular. It is of course true that foisting a language other than their own upon such children is equivalent to imposing an extra burden upon those least capable of carrying it. However, precisely because there are so many other pervasive reasons why such children achieve poorly the goals of majority-oriented and -dominated schools (and societies), removing this extra burden above--and leaving all else as it was--does not usually do the trick, particularly when the teachers, curricula, and materials for bilingual education are as nonoptimal as they currently usually are. (1976)

The preceding is not an indictment of bilingual education per se but an indictment of bilingual education as "compensatory" education. At Rock Point, not just the language of instruction has been changed; teachers, materials, and curricula have all been changed.

In a number of papers, Bernard Spolsky has pointed out that in the evaluation of bilingual education

> educational results are only one set of outcomes among several that are relevant. At each state of development, starting from the decision to establish a bilingual program, there are economic, political, sociological, psychological, religious and cultural factors and effects that need to be taken into account. What happens in the classroom is important, but it is also necessary to study the school in relation to the community it serves. (1974)

Such an analysis of the Rock Point experience--as is suggested by Spolsky--would require quite another monograph; suffice it to say that bilingual education at Rock Point has involved something more than a change in the language(s) of instruction. This change has been accompanied by changes in teaching personnel, materials, and methods and in school organization and governance; there have been complex and interrelated educational, linguistic, social, political, and economic changes in the school and in the community.

The millenium has not arrived. After 12 years, bilingual education at Rock Point and among the Navajo is still a precarious venture, beset by all the personal, institutional, and financial problems of new programs elsewhere. But the program has survived and has had some success. The importance of

the Rock Point experience is twofold. (1) At a time when the first flush of enthusiasm is over, and the academic efficacy of bilingual education programs is being seriously questioned, Rock Point's program emerges as one of the few American programs with relatively hard data, demonstrating over time the academic "success" that did not show in the first few years of the program. (2) The Rock Point experience may be understood to be saying that bilingual education programs for economically disadvantaged groups, if they are to be "successful," must involve much more than a mere change in the language(s) of instruction.

## NOTES

1. A common way of expressing achievement test scores is in terms of grade-equivalents. A school year is thought of as having 10 months. The national average for students in the sixth month of the third grade becomes the 3.6 norm, etc. The terms "years" and "months" in this section refer to grade-equivalent years or months.
2. Chinle Agency is the interior Agency of the Area, farthest from English-speaking population centers.
3. It is this pattern that some of the more emotional critics of Indian education are alluding to when they say that test scores for Indian students go down each year they are in school. The situation described is bad enough; one need not claim or imply that there is an absolute decline in test scores at each higher grade.
4. Bereiter and Englemann, in their various writings, have described the dilemma that minority and disadvantaged children face when entering school. These children begin school behind middle-class children--that is, they are often linguistically less competent in English than middle-class children and they have had fewer middle-class experiences on which school curricula are based. Consequently, these children must learn more and learn it faster to be caught up with middle-class children. This concept is commonly referred to as the Bereiter-Englemann dilemma. If we assume that most Navajo students start, in some nonmoral sense, "behind" middle-class Anglo students in academic achievement in English, and that it is desirable and necessary that they "catch up" with middle-class Anglo students at some point in their academic careers, then it will be necessary for Navajo students to go further and/or faster to catch up.

**Chart 1.** *A Comparison of Rock Point Student Achievement Mean Scores, Three-Year Accumulation, 1975-77, with the EFL Direct Method Student Achievement Mean Scores in Total Reading.*

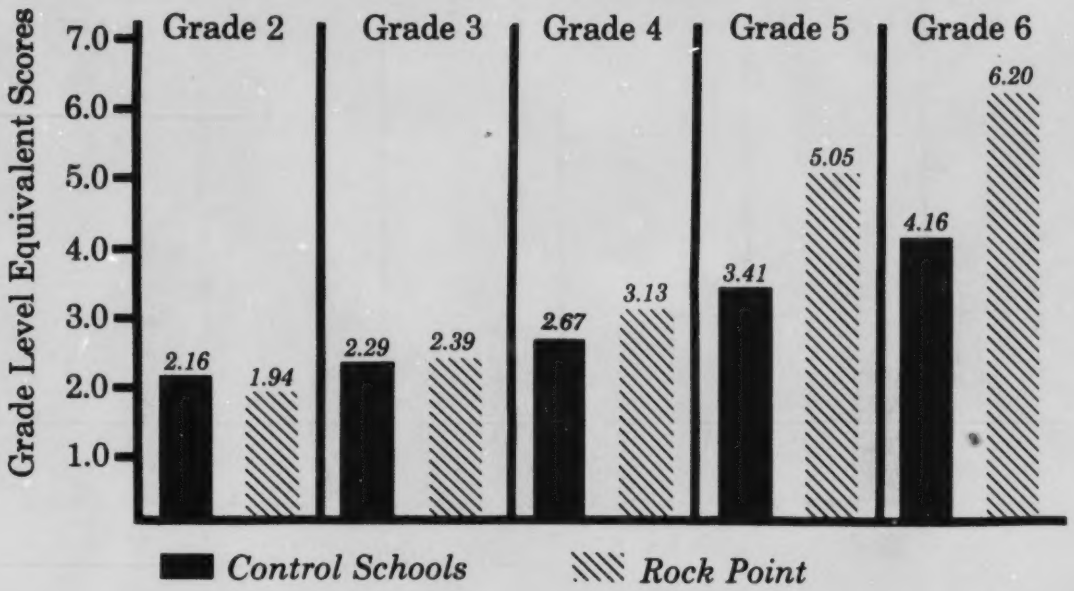



**Chart 2.** *A Comparison of Rock Point Student Achievement Mean Scores, Three-Year Accumulation, 1975-77, with the EFL Direct Method Student Achievement Mean Scores, 1975, in Word Knowledge Skills.*

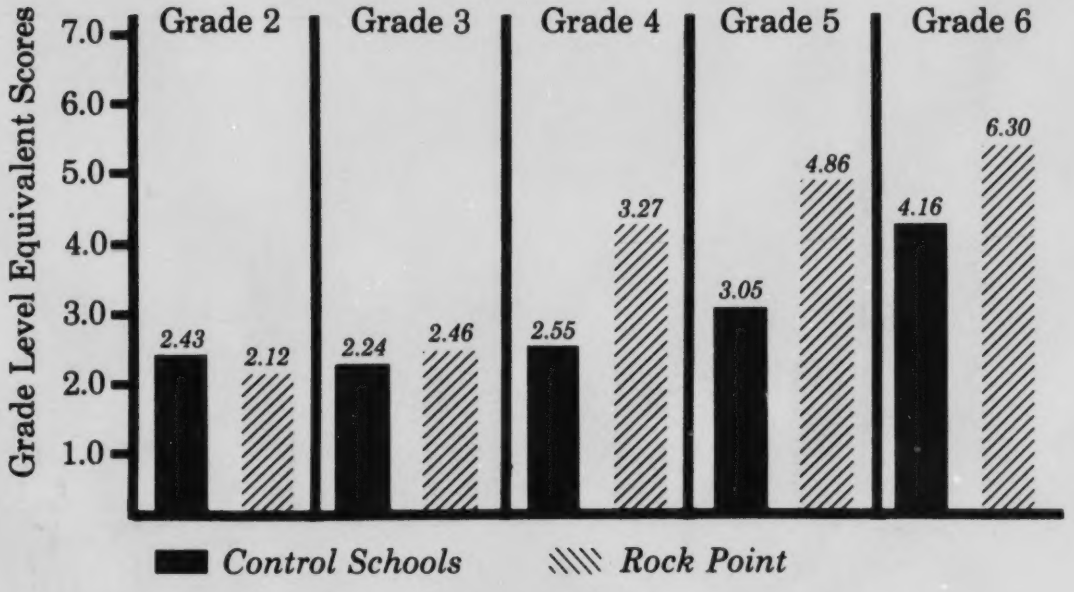


**Chart 3.** *A Comparison of Rock Point Student Achievement Mean Scores, Three-Year Accumulation, 1975-77, with the EFL Direct Method Student Achievement Mean Scores in Reading Comprehension.*

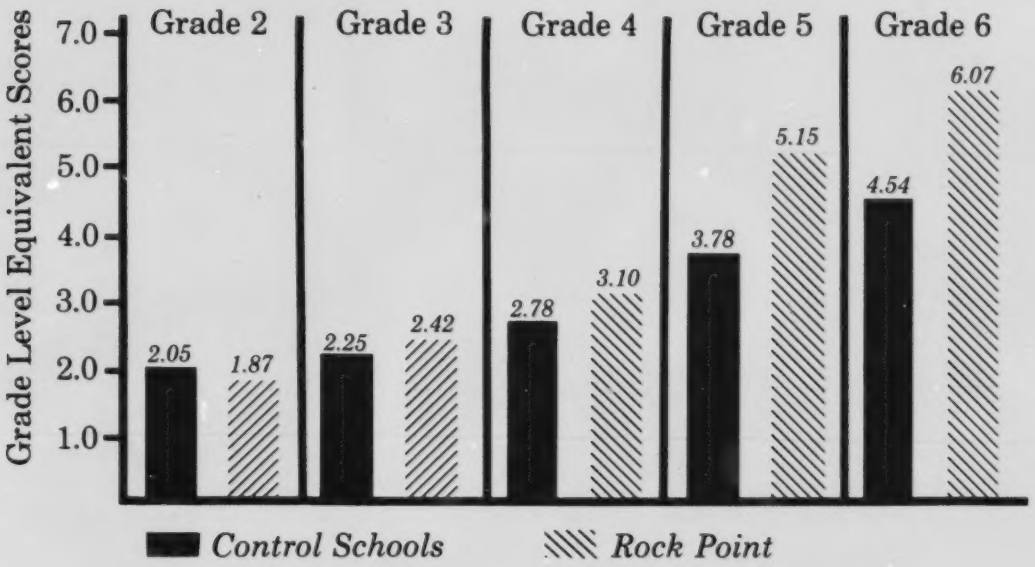



**Chart 4.** *A Comparison of Rock Point Student Achievement Mean Scores with the EFL Direct Method Student Achievement in Total Reading, 1975.*

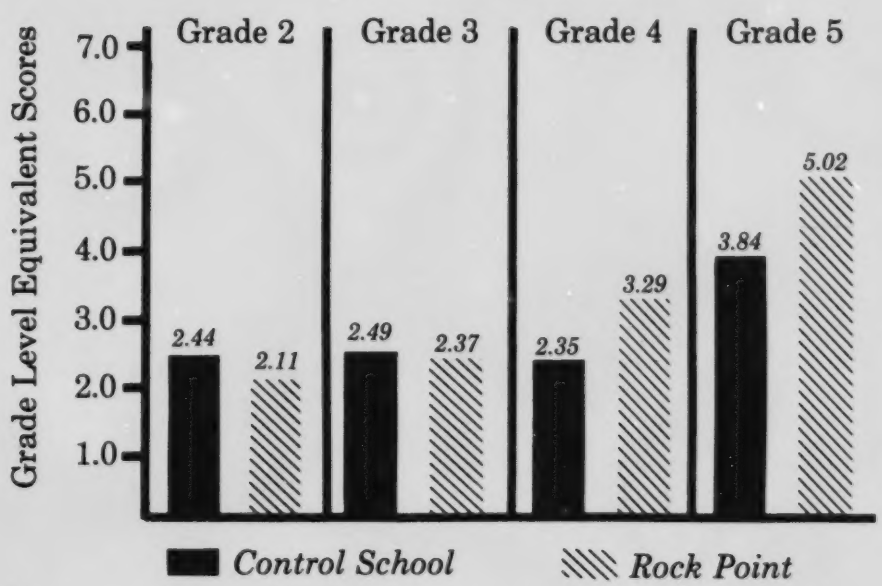


**Chart 5.** *A Comparison of Group Mean Percentage Scores of Rock Point Student Achievement, 1975-76 Average, with Chinle Agency Student Achievement and with Navajo Area Student Achievement, 1974, on the TOPESL Subtest English Structure.*

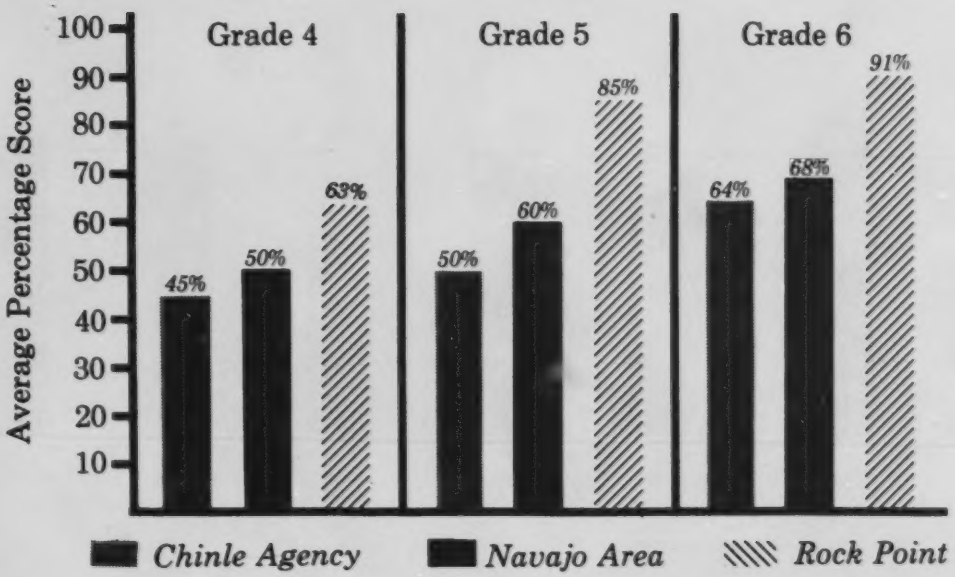



**Chart 6.** *A Comparison of Group Mean Percentage Scores of Rock Point Student Achievement, 1975-76 Average, with Chinle Agency Student Achievement and with Navajo Area Student Achievement, 1974, on the TOPESL Subtest Listening Comprehension.*

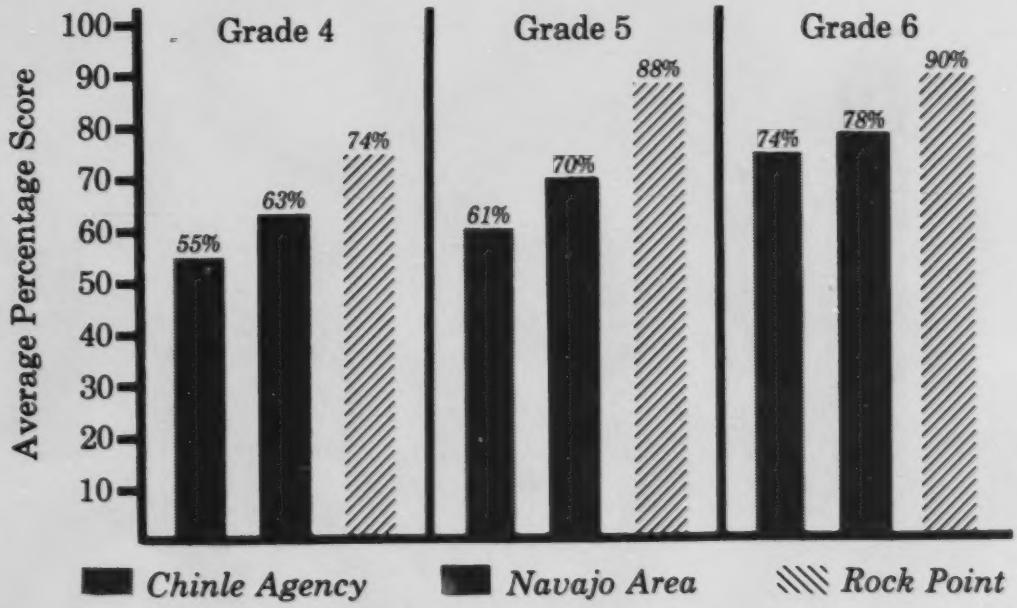
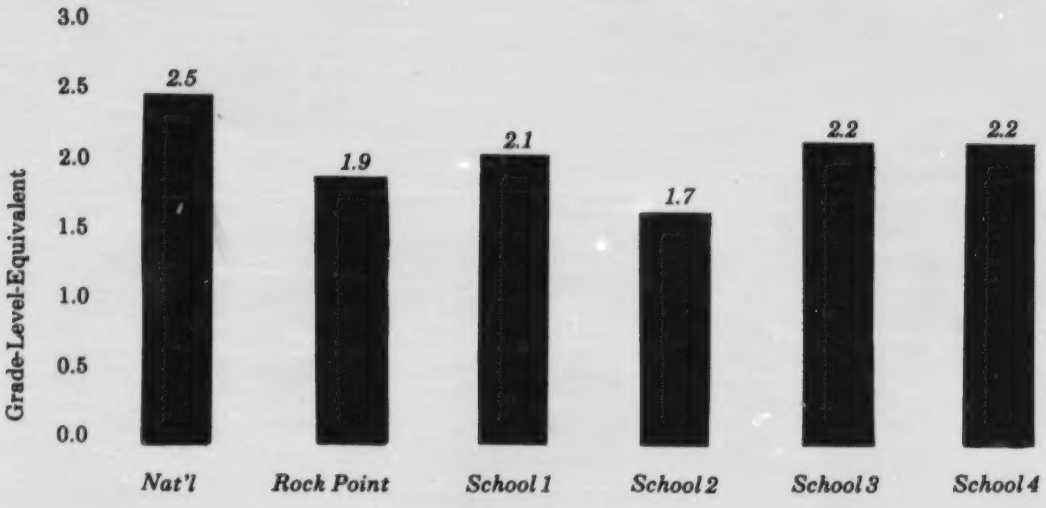


**Chart 7.** *A Comparison of the "National Average" Student Mean Score; Rock Point (Bilingual) Student Mean Score, Three-Year Accumulation, 1975-77; and the Student Mean Scores for Four of the Five Area Sample Schools (EFL Direct Method), 1975, on the Total Reading Component, Standard Achievement Test, Second Grade Level.*




*Note: No scores were reported for School 5 at the second grade level.

**Chart 8.** *A Comparison of the "National Average" Student Mean Score; Rock Point (Bilingual) Student Mean Score, Three-Year Accumulation, 1975-77; and the Student Mean Scores of Each of the Five Area Sample Schools (EFL Direct Method), 1975, on the Total Reading Component, Standard Achievement Test, Third Grade Level.*

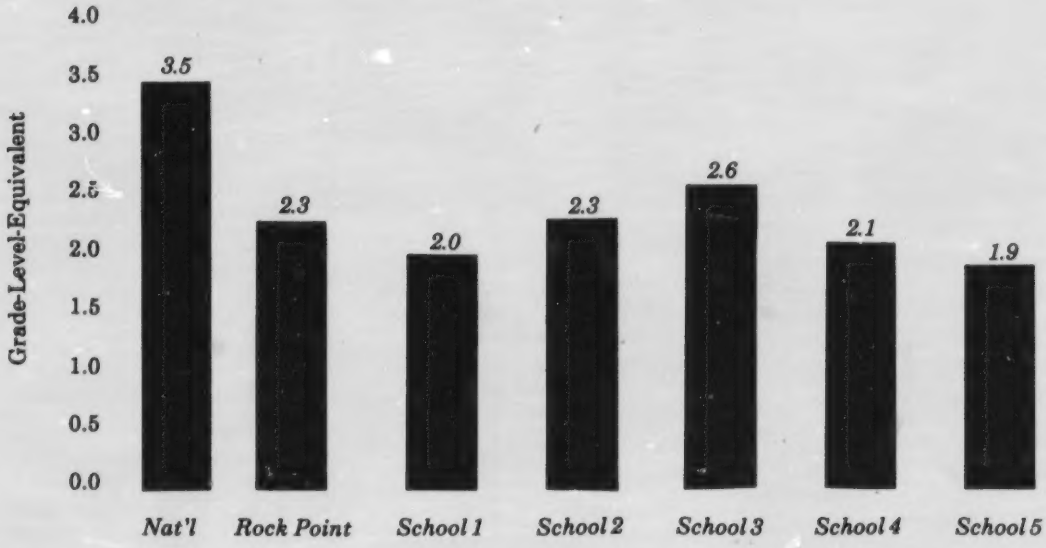


**Chart 9.** *A Comparison of the "National Average" Student Mean Score; Rock Point (Bilingual) Student Mean Score, Three-Year Accumulation, 1975-77; and the Student Mean Scores of Each of the Five Area Sample Schools (EFL Direct Method), 1975, on the Total Reading Component, Standard Achievement Test, Fourth Grade Level.*

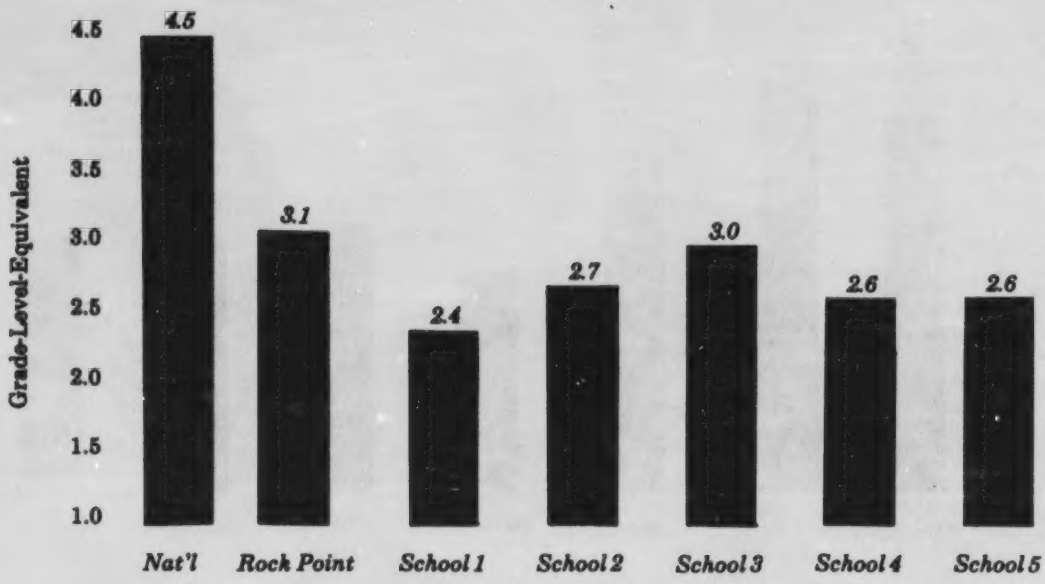



**Chart 10.** *A Comparison of the "National Average" Student Mean Score; Rock Point (Bilingual) Student Mean Score, Three-Year Accumulation, 1975-77; and the Student Mean Scores of Each of the Five Area Sample Schools (EFL Direct Method), 1975, on the Total Reading Component, Standard Achievement Test, Fifth Grade Level.*

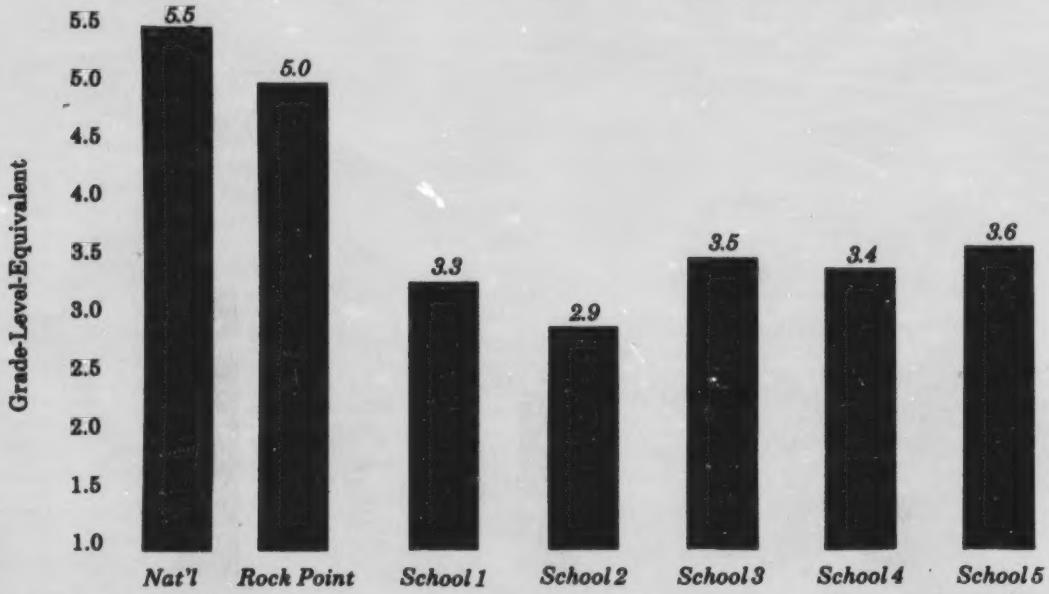


**Chart 11.** *A Comparison of the "National Average" Student Mean Score; Rock Point (Bilingual) Student Mean Score, Three-Year Accumulation, 1975-77; and the Student Mean Scores of Each of the Five Area Sample Schools (EFL Direct Method), 1975, on the Total Reading Component, Standard Achievement Test, Sixth Grade Level.*

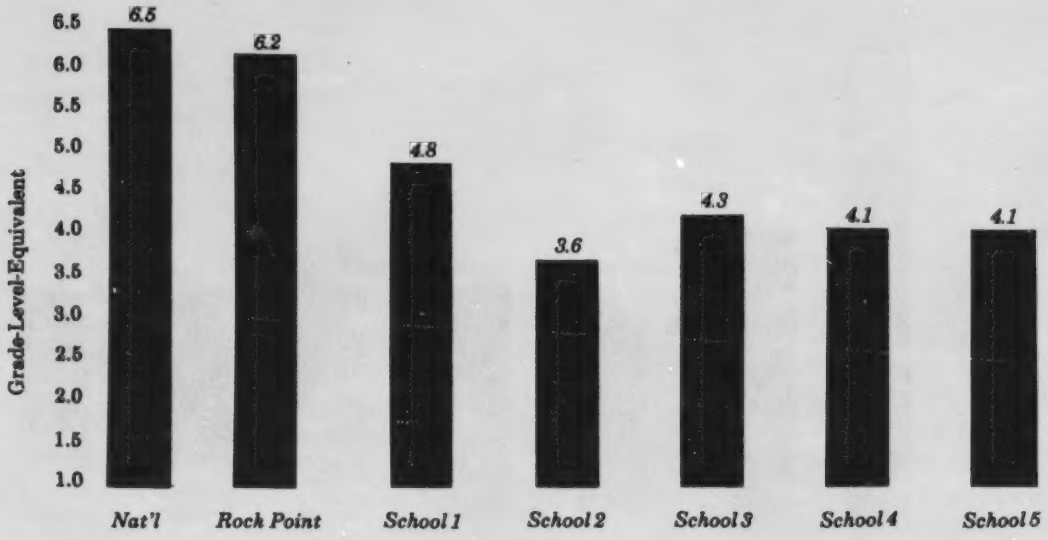
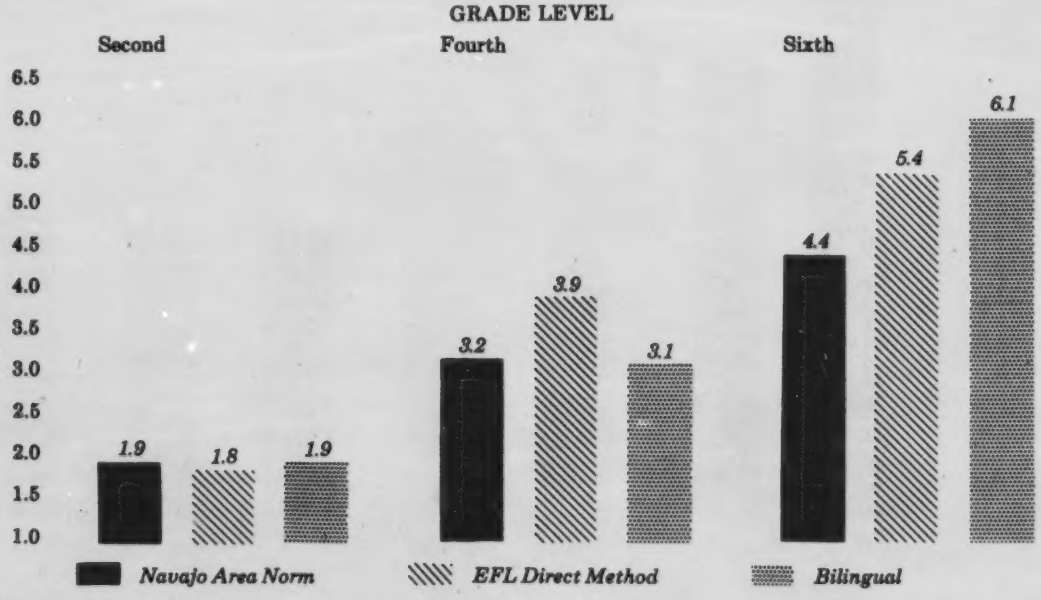



**Chart 12.** *A Comparison of Navajo Area (EFL Direct Method or NO Method) Student Mean Scores, 1970; Rock Point (EFL Direct Method) Student Mean Scores, 1970; and Rock Point (Bilingual) Student Mean Scores, Three-Year Accumulation, 1975-77, for the Second, Fourth, and Sixth Grades on the Paragraph Meaning (1970) and the Reading Comprehension (1975-77) Subtests, Stanford Achievement Test. All Mean Scores Converted to 1973-Edition Equivalent.*



# Appendix A

## RELATIONSHIP TO THE LITERATURE

The body of literature on bilingual education is growing, and several significant studies have been reported. Some of these have implications for or relate to the Rock Point Study. These studies will be described in the following sections: (1) literature that showed no difference in either monolingual instruction or bilingual instruction; (2) literature that supports monolingual instruction; (3) literature that supports bilingual instruction; and (4) literature with implications for bilingual education. In each section, the literature directly involving Navajo children will be presented first.

### Literature That Showed No Difference In Either Method

Several studies have been conducted with Navajo children; however, only the Rock Point Study compares Navajo children in EFL direct programs and Navajo children in a bilingual program where initial reading was taught in Navajo. Therefore, all of the studies described in this section are with non-Navajo children.

Horn conducted a reading readiness study with Spanish speaking children; the study involved three approaches to reading readiness. Horn divided 28 first grade classrooms in three groups: the first group used an oral-aural English readiness method; the second group used an oral-aural Spanish readiness approach; the third group did not use an oral-aural approach, but used the school district's culture fair materials. The groups were pre- and post-tested using the Metropolitan Readiness Test. The post-testing demonstrated no significant difference between the groups. Horn concluded that most standardized tests are inappropriate instruments for this type of investigation (1966).

Huzar compared two groups of Puerto Rican children at the second and third grade levels. The experimental group had participated in bilingual instruction since entering school; the control group had been taught in English only. (The terms "experimental group" and "control group" are used extensively throughout this section. Experimental group refers to a group of children who received some type of bilingual instruction. Control group refers to students taught in a monolingual instruction program; in most cases the language was English.) Huzar found no significant difference in reading with all students, but in a comparison of boys only, there was a difference in favor of the experimental group (1973).

Valencia reported on a bilingual program with Mexican-American children in Pecos, New Mexico. The experimental and control students had participated in the program since entering school. The two groups were tested at the end of fourth and fifth grades, using the California Achievement Test. There was no significant difference between the groups at either level (1970).

Cohen studied the achievement of Mexican-American students in Redwood City, California and was concerned with several aspects of learning and attitude development. One aspect dealt with reading. Students, except for one experimental group, started reading simultaneously in both English and Spanish; the experimental group learned initial reading in Spanish. Children taught using a bilingual curriculum were compared with children taught using the state curriculum--a monolingual English program. The study was conducted over a three-year period, and students were tested with the Murphy-Durrell Reading Readiness Analysis Test.

The results of the research found no significant difference in reading achievement between the two groups of students. Cohen did find significant differences in two related aspects of the study. He found that the children in the bilingual curriculum were "significantly more positive toward the Mexican culture," and that these same students expressed attitudes toward Anglo culture which were as positive as those expressed by the students taught using the curriculum recommended by the state. Also, the attendance of children in the bilingual program was much better than that of the students in the state program, and the students in the bilingual program expressed a more positive attitude toward school than did the control students (1975).

Two other studies conducted by Skoczylas and Velasquez showed similar results. There was no significant difference in general achievement, but both studies concluded that children seemed to demonstrate more positive self-images when instructed in a bilingual curriculum (1972; 1974).

Herbert reported on a sample of four projects in the state of Texas, located in the cities of Houston, Alice, San Antonio, and Abernathy. In each project, experimental and control groups were established. The experimental students were introduced to reading in Spanish and later in the year, to English reading, while the control students were taught initial reading in English. Results at the end of first grade were reported for only three projects. The test results in two of the projects indicated a significant difference in favor of the control groups. In the other program, there was no difference. Herbert examined the relationship between the Spanish reading achievement and the English reading achievement of the experimental students. He found that those who scored well in Spanish reading also scored well in English reading. This may or may not be the result of the transfer effect (1971).

These studies indicate that there is little difference in achievement at third grade and below. Herbert's report showed that the children in the monolingual English programs scored significantly higher than the children in the bilingual program. The Rock Point Study supported these findings; at the second grade level, students' achievement at Rock Point generally was below that of students in EFL direct method programs. At third grade level, Rock Point students' achievement was equal to that of the EFL direct method students' achievement, but only in a few cases were there significant differences. One conclusion drawn from the combined results of these studies is that gains in achievement in bilingual programs do not begin to appear on standardized tests until later--fifth or sixth grade. Children need more than one or two years of bilingual instruction to benefit from such instruction.

### Literature That Supports Monolingual Instruction

There have been studies of the effects of using Teaching English as a Second Language (TESL) techniques with Navajo children. Although none of these studies compares TESL techniques with the bilingual method, the studies have provided useful information. Willink compared achievement of Navajo students who received TESL instruction with those who did not. She found

a significant difference in achievement scores in favor of using TESL instruction (1968). This study was of particular interest because one of the experimental schools was Rock Point Community School, which was the focal point of this report. Willink collected the data in 1967; none of the students in her study had received bilingual instruction.[1]

Shipp investigated the achievement of Navajo second and third graders who attended school in the eastern portion of the Navajo reservation. The study was a comparison of the reading achievement of children taught using the Direct Instructional System for Teaching Arithmetic and Reading (DISTAR) with the reading achievement of children taught using non-DISTAR materials (1975). The publishers claim that one function of the DISTAR program is to provide special remedial work for second language speakers. The DISTAR curriculum is designed for a broad population and is not designed specifically for Navajo children as the CITE and NALAP curricula are (Yungho, 1972).

Stahl examined the effects of CITE instruction on students' reading achievement, comparing children's achievement in CITE programs at the second grade level with the achievement of students in non-CITE programs. He compared students in 12 paired schools--one school of each pair used CITE in the primary grades and the other school of the pair used a non-CITE program. He found an overall significant difference in reading achievement of the students instructed using the CITE curriculum. In the paired situation, four CITE programs are significantly superior. The control school test scores were superior to the two experimental schools' test scores in the other two pairs.[2]

The literature that focuses on the EFL direct method with reference to Navajo students is limited, but the evidence indicates that organized TESL curricula are more effective than non-TESL curricula. The remainder of this subsection describes studies and literature in non-Navajo bilingual situations.

The Rizal Study was conducted in the Philippines in the early 1960s. The study compared children who received vernacular instruction with those who received continuous monolingual English instruction. The students taught in the vernacular spent the first two years of school in that language, then switched to English. The results of the study at the sixth grade level showed that the children who had English the longest--beginning initially in English--did better than students introduced to school subjects in the vernacular (Engle, 1975).

Pozzi-Escot conducted a study of the bilingual method and EFL direct method in Peru. She studied three groups: one group used the bilingual method; one group used the EFL direct method; and the control group used the regular curriculum. After three years the groups were tested in their competency in reading Spanish. The group taught using the EFL direct method scored the highest. The tests and group compositions were not described, nor were statistical data provided (Engle, 1975).

Probably the strongest support for monolingual instruction is the St. Lambert Experiment. Lambert and Tucker (1972) and Lambert (1974) reported on this unique experiment. Conducted in Canada, the study reflects the English-French bilingual situation of that nation.

Three groups were established. The experimental group was composed of English speaking children who entered a French immersion kindergarten program. They remained in a total-immersion monolingual French program until second grade, then English language arts were introduced for one hour a day. All other subjects were in French, taught by native French speaking teachers. The second group, the English controls, received the regular curriculum with one hour a day of French as a Second Language (FSL) instruction. The third group, the French controls, received the regular French curriculum for French

schools in Canada. All children in the study were from middle and upper classes.

The study examined several factors, but two are relevant to this problem. First, it compared the English language skills of the experimental students and the English control students to see if the experimental group had been limited in English development in any way. Second, a comparison with both control groups was conducted to determine how the experimental group compared in French. The results at the end of the fourth grade were impressive. The comparisons of English skills on standardized tests showed that the performance of the experimental group was equal to that of the English control group.

The comparison of French skills is more relevant to this study. The experimental group's performance was far superior to that of the English control groups who received FSL instruction. They performed nearly as well as the control group of native speakers in French competency and scored as well as the French control group in all the reading areas on the standardized tests (1972 and 1974).

The Elgin Study conducted by Barik and Swain supports the St. Lambert Experiment. The Elgin Study compared students who spent a half day in English and a half day in French with those students who participated in the St. Lambert Experiment. At the end of third grade the Elgin students were competent in French at the same level achieved by the St. Lambert students at the end of first grade. Barik and Swain provide no socioeconomic information, but it is assumed that the Elgin students were middle class (1974).

The St. Lambert Experiment's methodology is supported by a similar curriculum used in the Toronto French School. The program has existed for 13 years. A significant feature of this program is that children enter it at three or three-and-a-half years of age--a much earlier age than that of children entering most traditional programs. The children enter the school as monolingual English speakers. The curriculum is conducted entirely in French until the second grade; English reading is then introduced at that level.

Children seem to learn to read well in both English and French, but no information is provided as to how well they read French. Some data were provided on English reading which indicated that by sixth grade the students performed as much as three years above grade level (Giles, 1971). The achievement results of both the St. Lambert Experiment and the Toronto French School indicate that students were not retarded in their native language by participating in a bilingual program.

These studies, particularly the Canadian reports, strongly support monolingual-immersion instruction. The Navajo studies all focus on TESL and none compared monolingual TESL instruction with bilingual instruction. The Rock Point Study supported the use of well-developed TESL curricula, and one component of the Rock Point program was a strong kindergarten through sixth grade TESL or EFL program. The Rock Point Study goes beyond the work of Willink, Shipp, and Stahl, whose work indicates that students' achievement in TESL curricula is superior to the achievement of students in monolingual English non-TESL curricula. The Rock Point Study indicated that combining a well-developed TESL program with instruction in Navajo--formulating a bilingual curriculum--creates an instructional climate in which students achieve beyond the levels of students in monolingual-TESL programs.

The strongest support for the monolingual instruction is found in the Canadian studies. Two features of the Canadian programs need to be examined.

First, socioeconomic factors must be considered. The children in the

Canadian programs were upper and middle class children, whereas, the children in the Rock Point Study were from poverty backgrounds. The Canadian middle class students' motivation to learn French may be much higher than the motivation for Navajo children to learn English.

Second, the cultural environment of the children in the Canadian programs was monolingual-bicultural--children entered school speaking only English but lived in an environment of two distinct cultures in which both English and French were spoken. By contrast, the children in the Rock Point Study lived in a monolingual-monocultural situation. The only cultural environment in which they regularly interacted was the Navajo culture, and Navajo was the dominant language; consequently, the opportunities to hear and use the second language were fewer for these children than for the children in the Canadian programs.

The monolingual instruction was effective with middle-class children in a bilingual environment. The Rock Point Study indicated that a bilingual approach was more effective in a non-middle class, monolingual-monocultural situation.

## Literature That Supports Bilingual Instruction

Cottrell reports on a study of the effects of bilingual instruction on Navajo students attending school in San Juan County, Utah. An experimental and a control group were used in the study. The experimental group consisted of kindergarten and first grade students who went to school at three elementary schools on or near the reservation and who were in their first year of bilingual instruction. They received oral Navajo instruction, but no attempt was made to teach literacy in Navajo. The control group was composed of Navajo students who attended school in the Anglo community of Blanding. Prior to the introduction of the bilingual program, the Blanding students had consistently scored higher on standardized tests. The California Test of Personality, an Oral English Response Test, and the Metropolitan Readiness Test were all administered. The experimental group scored equal to or higher than the control group at both grade levels (1971).

Hall reports on two early studies in the Philippines and in Sweden. The Iloilo I study conducted in the Philippines was organized in the same pattern as the Rizal study but was conducted 10 to 15 years earlier. The experimental group received instruction in the vernacular during the first two years and switched to English at third grade. The control group received monolingual English instruction only. At the end of the third grade, the experimental group was superior in oral English, reading, social studies, and arithmetic (1970).

Venesky reports that at the sixth grade level, the Director of Public School Instruction in the Philippines ran an independent study with the same students. He found the control group to be superior in all areas (1970). Although the results of the Iloilo Study were somewhat confusing and contradicted the Rizal Study, the Philippine government instituted a national bilingual educational program as a result of the study.

A Swedish study compared an experimental group which received 10 weeks of initial literacy in a local dialect before beginning reading in Swedish with a control group which received initial reading in Swedish only. At the end of the first year, the experimental students did significantly better in word recognition, speed, and accuracy in reading (Hall, 1970).

Gudschinsky described several bilingual programs in Peru. The programs were located in two broad geographic areas--the mountain region and the

jungle region. In both situations, children spent the first two to three years in a bilingual curriculum. Content subjects and initial literacy were taught in the native language, and Spanish was taught as a second language. By the sixth grade level, the students introduced to literacy in the native language were far superior in Spanish reading to children who were taught in Spanish only (1971). Gudschinsky does not provide any statistical data to back these claims, and the results seem to be in conflict with the Pozzi-Escot study.

Several studies have been conducted with Spanish speaking children in the United States. Although no studies have provided conclusive evidence of the effectiveness of the bilingual instruction, they have provided favorable indicators.

Kaufman conducted a study in New York City with Puerto Rican seventh grade students. Two schools were used in the study, each having an experimental group and a control group. The two experimental groups received varying degrees of Spanish reading instruction; the control group continued in the monolingual English program. The experimental group was superior in English reading in one school, and there was no difference in the groups at the other school. Kaufman concluded that there was some evidence of skill transfer in the one school (1968). Del Buono reports similar results with seventh grade Mexican-American students (1971).

Covey conducted a similar study with high school freshmen in Phoenix. Experimental and control groups were established. The experimental group received more bilingual instruction than students in the Kaufman study did. Covey examined the effects of Spanish instruction on English, mathematics, and English reading performance. He found a significant difference in favor of the experimental group in all areas except mathematics (1973). The limiting factor of these studies is that they did not focus on initial reading, which is the primary focus of the Rock Point Study; however, the implications of the studies are worth noting.

A San Antonio study that focused on Mexican-American children in four schools has received national recognition. Experimental and control groups were established in each of four elementary schools. The experimental groups received initial literacy in Spanish; the control groups were introduced to reading in English. Pryor reported on the results at the end of first grade. In one school, the experimental group performed significantly higher in reading achievement. In two other schools, the experimental group scored higher, but not significantly so; in the fourth school, there was no significant difference (1967). Engle reported that testing at the end of the second year revealed no significant difference in the groups. The only other testing reported was a test of oral English proficiency, given during the fifth year of the project at the fifth grade level. The experimental groups scored higher than the control groups on the test (1975).

Trevino investigated Mexican-American children's achievement in arithmetic, using a bilingual approach. The study covered a three-year period, beginning at the first grade level, where all the children received bilingual instruction. Each year, a new grade level was added and test results were compiled; at the end of third grade the investigation was completed. The children's performance was compared with previous students' performances and the national norm for the test. All but one third grade student scored at or above grade level. Prior to the introduction of the bilingual program, student achievement generally was well below the national norm (1970).

Olesini studied the achievement of Mexican-American children at the third grade level, comparing those who had received at least two years of bilingual

instruction with those who were instructed in English only. He examined the achievement in several curricular areas, including reading, and found a significant difference in favor of the bilingual students in all curricular areas except spelling and arithmetic computation. He concluded that bilingual children of both sexes achieved greater gains in the academic curricula when they were instructed by bilingual methods (1971).

The study which is most often cited in support of bilingual instruction and which provides the clearest evidence of the effectiveness of the bilingual method is Modiano's Chiapas Study. Three Indian tribal areas in the highlands of Chiapas, Mexico were used in the investigation. There were two school systems in the region. The state system provided the control group, which received instruction in Spanish only; students in the federal system comprised the experimental group and received instruction through a bilingual approach. Two instruments were used to measure reading comprehension in Spanish: teachers appraised each student's reading comprehension skills and Modiano developed a reading comprehension test.

At the end of third grade, the experimental group scored significantly higher on both instruments. Modiano drew two major conclusions from her study, the first being that children taught to read in the native language learned two skills: reading and speaking a new language. The learning of the two skills was separated, however, because the children learned the skills of reading in a language in which they already were competent while they learned a second language (Spanish). After the children read proficiently in their native language, they transferred the skills of reading to the second language, in which they had developed a degree of oral proficiency. The children did not repeat reading readiness, but learned additional symbol/sound associations and reading rules unique to Spanish.

Modiano's second conclusion was that the children taught in the national language (Spanish) only had to learn two skills; however, they were required to learn both skills in the same language--i.e. while they were developing proficiency in a new language, they also were required to learn the skills of reading in that language (1966). The separation of learning the two skills--language learning and reading--formulates one of the important theories of bilingual education. Modiano's work supported this theory that a child can learn both skills more proficiently if they are separated.

These studies all support bilingual instruction. The Olesini, Trevino, and Modiano reports all provide strong evidence of the effectiveness of this approach, and the Rock Point Study strengthens this body of supportive data. The Rock Point Study is significant from two perspectives: it covers more grade levels two through six than any of the studies reported, and it has a longitudinal aspect--achievement scores in reading were gathered for three consecutive years, and the pattern of achievement results remained consistent over the three-year period.

## Literature With Implications For Bilingual Education

This section contains descriptions of studies and reports that have implications for bilingual education or relate to the Rock Point Study.

Odle compared reading achievement of Navajo eighth graders in three types of school systems. Type I was a system operated by the BIA exclusively for Indian children. Type II schools were public schools located on the Navajo reservation and operated by the state. Type III was the bordertown system, in which Navajo children are housed in one of the towns bordering the Reservation and attend the regular public schools. The students selected for the

study were Navajo language dominant; they were selected on IQ and age criteria. The basic instrument of the study was the SRA Achievement Survey.

The results indicated that there was no significant difference in reading achievement between students in reservation public schools and students in BIA schools. Odle did find a significant difference in achievement with the bordertown students, who did better than students in both reservation public schools and BIA schools. She concluded that this difference may have been due to the environment of the bordertown, where there was more opportunity for exposure to English (1976).

Bass found similar results in a national study of Native American students. He compared the achievement of Native American high school seniors who were in public schools, BIA schools, and mission schools. Navajo students were one of several tribal groups involved in the study. Bass found no significant difference in comparisons of public school student achievement and BIA school student achievement; however, mission school students did score significantly higher (1969). The students in both the Odle and Bass studies were in monolingual English programs. There is no record of any of these students participating in a bilingual program.

The Soviet Union has had established bilingual programs since the revolution. Kreusler described some of the effects of these programs. The bilingual approach has allowed the Soviets to introduce Russian in areas where the Csars were unable to do so. They have been able to unite the country by using instruction in the local vernaculars to acculturate the minorities (1961).

Bingham seems to support Kreusler's conclusions and notes two important additional points. In northern Siberia, the people have traditionally been isolated from the rest of the country; however, since the revolution, with the introduction of bilingual education, this region has produced many professionals--such as engineers, doctors, and teachers. Also, in two areas of the north, the bilingual programs have deteriorated in favor of monolingual Russian schools. The national education ministry found that since this change these areas now have a high dropout rate, and students' academic achievements are inferior to that of students where quality bilingual programs have been maintained (1975).

Macnamara studied the reading ability of compound bilinguals and compared the children's reading ability in their stronger language with their reading ability in their weaker language. Three groups of children were studied: two groups were composed of compound English-Gaelic bilinguals and the other group was composed of compound English-French bilinguals. All the students in the investigation were dominant in English. The experiment involved several reading tasks such as problem solving, speed reading, and analyzing reading selections.

The experiments demonstrated that children could read and solve problems faster in the stronger language. Significant differences between the stronger and weaker languages were found in the interpretation of the words and sentences, the pronunciation of words, and the ability to anticipate the sequence of words. Macnamara concluded:

> . . . the slower rate in the weaker language does not allow any added leisure time for thinking about what is read . . . the time is fully employed on the task of decoding language. Consequently, some important points may slip his mind . . . (as) difficulty of the problem increases a man is more likely to fail. (1970)

Lum compared two approaches for teaching English to Chinese students, focusing on the development of English oral proficiency. Conducted in San

Francisco, the study compared students who were in bilingual programs with those in an EFL direct method program. The students were tested at the end of first grade. The students that were taught using the EFL direct method were approximately six months ahead of the bilingual students in oral English. Lum believes this to be the direct result of language interference. Students in the bilingual program were having structural interference reinforced by the use of Chinese in the classroom (1971).

A study conducted in Ghana provides some insight into what may occur when a child who speaks limited English, no English, or a nonstandard dialect of English is confronted with a monolingual standard-English curriculum. The study was based on Vygotsky's work (1965). A hierarchy of four levels of thought development was established following Vygotsky's suggestions of cognitive maturation. Ghana has two major native language regions; English is the national or business language, and, in many areas, English is the language of instruction in the classroom.

Collison, the researcher, set up a series of science-related activities requiring thinking that involved all four levels of thought development. Collison performed the activities separately in English and in each of the regional languages. The activities were not language bound--i.e. they could be discussed in any language. The students in the study were from 13 to 15 years of age, and all were dominant speakers of one of the regional languages. Collison tape-recorded the discussion periods, and analyzed the student responses in English and the native languages. The remarks of the students were classified into each of the four levels of thought development.

The results of the study showed that student responses in English were limited to the first and second levels of thought development, with the majority at the most simple level. In the native languages, the student responses reflected thought development at all levels, with the majority of responses at the second and third levels. Collison believed that limited ability to speak English had a direct effect on cognitive development. The basic conclusion was that the children must understand the language of instruction to fully develop their cognitive processes (1974).

Collison's work seems to indicate that language and thought development are interdependent. This hypothesis is supported by the work of Bruner (Wilson, 1973), Vygotsky (1965), Bernstein (1964), Luria (1968), and Blank (1974). The implications suggested by these studies either are supported by the Rock Point Study or suggest concepts that reflect on the Rock Point Study but need further investigation.

The Rock Point Study focuses essentially on BIA schools. The Bass and Odle reports provide a bridge for extending the implications of the Rock Point Study to Navajo students in public schools. The type of school system--public or BIA--seemed to have no effect on student achievement. The implications of the Rock Point Study are that the type of curricular program is more significant than the type of school system. The achievement of children in public schools should increase through the use of bilingual programs.

Macnamara's work has more interesting implications. Students read better (comprehend more) in their strongest language; therefore, if students are to have the best opportunity for developing comprehension skills, these skills should be developed in the student's strongest language. The Rock Point Study supports this conclusion. The data collected through the comprehension subtests indicate that if children first learned comprehension skills well in Navajo, then these skills transferred to English.

The results of reading achievement in Navajo cannot be compared by the use of standardized tests, since no standardized reading tests are available

in Navajo. But one measure of achievement is the difficulty of reading materials for a given grade level. The most difficult material in print in Navajo, in terms of vocabulary and content, is the *Navajo Historical Selections*,[3] first printed in 1948. The booklets are transcriptions of taped interviews with influential Navajo leaders of that period and were designed for adult readers. By April of 1975, the average third grader at Rock Point could read any of the *Selections* proficiently. This achievement was far beyond the expectations of the teachers, administrators, and project personnel.

Lum's study follows the pattern described in the first section of this Appendix. The initial year of bilingual instruction provides little evidence that such instruction is more effective than monolingual instruction. The Rock Point children scored lower than the children in the EFL direct method programs at the second grade level. This study strengthens the conclusion that more than a few years of bilingual instruction are needed to show significant results.

Collison's report suggests the need for further investigation of the role of language and cognitive development. Vygotsky may be correct; if he is, then the language of instruction is more significant than American educators have been willing to acknowledge. Collison's experiment implies that the language of instruction is important if children are to develop cognitive skills fully. The Rock Point Study supports Collison's work as follows: the Rock Point children seem to have transferred skills to the point that they achieved in English reading and arithmetic beyond the levels of children taught only in English.

## NOTES

1. Elizabeth W. Willink, personal interview, December 30, 1976.
2. Richard Stahl, personal interview, September 17, 1976.
3. The *Navajo Historical Selections* were put out by the Bureau of Indian Affairs and later were included in the University of New Mexico's *Navajo Reading Study*.

# Appendix B

This appendix is composed of a description of the study's methodology and the findings of the study, which include the statistical analyses. The information in these two sections came essentially from the dissertation "A Comparative Study of Two Approaches of Introducing Initial Reading to Navajo Children: The Direct Method and the Native Language Method" (Rosier, 1977). The sections have been modified by adding the methodology used for the arithmetic and English proficiency components and the findings of these two components.

Portions of the "Findings" chapter of the dissertation were not included (the boys compared to boys and the girls compared to girls); therefore, the numbering of tables in the findings section of this Appendix is not completely sequential. There are gaps where the tables displaying the boy-girl comparisons are not included.[1] In all cases the tables have discrete identifying numbers, i.e. no two tables have the same number. The tables are grouped at the end of the Appendix.

## METHODOLOGY

### Introduction

Several studies have been conducted that relate to the problem of this investigation, but only a limited number of researchers have made comparisons between the bilingual method and the EFL direct method. Usually, comparisons between one of the two methods and the standard curriculum have been made, e.g. a comparison between bilingual students taught using TESL techniques and bilingual students taught using a curriculum primarily designed for native English speakers. This chapter is an outline of a research design that allowed for a comparison of the two methods.

The design of the study was structured after the Post-Test-Only Control Group Design model described by Campbell and Stanley (1966). This model was modified to meet existing conditions. Two divergences from the model were required: the participating schools were selected based on curricular criteria and were not randomly selected, and two control groups were used rather than one in the reading component of the study. The two groups are referred to as the baseline control group and the concurrent control group. The criteria for selecting participants and a description of the two control groups are presented in the following sections.

### Population and Sampling

The experimental group in this study was limited to Rock Point Community School. Since the validity of this study depends on the matching of the students in the control groups with the students in the experimental group,

a brief description of the organization and curriculum of the experimental school is provided.

From kindergarten through second grade the classrooms were organized as "coordinate bilingual classrooms." Each class had two teachers. The Navajo Language Teacher (NLT) used Navajo for instruction and introduced initial literacy in Navajo. All content areas were introduced in Navajo first. The English Language Teacher (ELT) used English for instruction and taught the English language using second or foreign language techniques. In addition, the ELT taught the English for arithmetic concepts introduced in Navajo. At the second grade level, the ELT introduced English reading, and the classrooms were organized into language areas, half of the classroom for each language.

A homeroom, departmentalized program was used from third through sixth grade. The homeroom had one teacher, an ELT, and the language of instruction was English. The ELTs at these levels continued to use TESL techniques. The curriculum was limited to language arts, arithmetic, and, if time were available, English social studies. Children left the homeroom in half-class groups to attend departmentalized subjects in Navajo, including Navajo literacy (language arts), science taught in Navajo, and Navajo social studies.

The time spent for instruction in each language varied among grade levels. In kindergarten, 70 percent of the instruction was in Navajo. For beginners (six-year-old children who were unable to attend kindergarten or who did not meet the kindergarten objectives) and first and second graders, approximately 50 percent of the instructional time was in each language. For third through sixth graders, 75 percent of the instruction was in English.

The two control groups included selected samples of students in BIA schools on the Navajo Reservation. These schools used the EFL direct method. Both control groups were composed of five schools, which were selected using the following criteria:

(1) The schools had a program which included grades kindergarten through sixth.

(2) The schools had an established CITE, NALAP, or other recognized TESL program.

(3) There were two people per classroom involved in instruction in grades kindergarten through second. This was either a teacher-teacher relationship or a teacher-teacher aide relationship, but both people actually provided instruction.

(4) At least one of the two instructors had native competence in Navajo.

(5) The index of language dominance of entering six-year-olds for each school was within the limits of 3.48 to 5.00. Data were collected on entering six-year-olds in over 90 percent of the BIA schools in more than 50 percent of the public schools on the Navajo Reservation. From the data gathered, Spolsky developed a scale of language dominance and assigned each school an index number. The index scale ran from 1.00, which represented a school 100 percent English dominant, to 5.00, which represented a school 100 percent Navajo dominant. The experimental school's index was 4.24 (Spolsky, 1971).

### Data Collection

There were two comparisons used in the reading component. The first compared the experimental group with the baseline control group. The control group in this case was tested in February, 1975 to establish baseline data. The experimental group was also tested at that time and was tested again in

February, 1976 and February, 1977. The instrument used in this comparison was the Stanford Achievement Test (SAT), 1973 edition.

All administrations of the test were considered post-tests. Scores from three subtests--Word Study Skills, Reading Comprehension, and Total Reading--were used. The following levels of the Stanford Achievement Test were given: (1) the Primary I Level was given to the second grade; (2) the Primary II Level, to the third grade; (3) the Primary III Level, to the fourth grade;[2] (4) the Intermediate I Level, to the fifth grade; (5) the Intermediate II Level, to the sixth grade.

The second comparison was between the experimental group and the concurrent control group. Both groups were tested over a one-year period. The BIA school system and Rock Point Community School both administered the Metropolitan Achievement Test (MAT) system-wide in April, 1976; this administration was considered a post-test. All children in the control and experimental groups in grades second through sixth were tested. Three scores were gathered--Word Knowledge, Reading Comprehension, and Total Reading. The following levels of the Metropolitan Achievement Test, 1971 edition, were administered: (1) the Primary I Level was administered to the second grades; (2) the Primary II Level, to the third grades; (3) the Elementary Level, to the fourth and fifth grades; (4) the Intermediate Level, to the sixth grades.

The baseline comparison was also used for the arithmetic portion of the study. The Stanford Achievement Test was used to measure arithmetic achievement of students in both groups, which were tested in February, 1975. Scores at the second grade level were gathered from the Total Arithmetic, Computation, and Application subtests. For the third through fifth grade levels, scores were gathered from Total Arithmetic, Concepts, Computation, and Application subtests. The same levels of the SAT as listed previously were administered at each grade level.

The English proficiency component was a comparison of the achievement of Rock Point students with Chinle Agency student achievement and with the achievement of Navajo Area students. The Navajo Area and Chinle Agency schools administered the Test of Proficiency in English as a Second Language (TOPESL) test to all children in grades four through six in 1974. Rock Point administered the TOPESL Test in 1975 and 1976 to all students in fourth through sixth grades. Two subtests of the TOPESL--the Listening Comprehension Test and the English Structure Test--were administered to all children. The data gathered from Rock Point in 1975 and 1976 were compared with the Navajo Area and Chinle Agency 1974 data.

## Statistical Analysis

Data were collected for each of the two comparisons in reading--the experimental group and the baseline control group; the experimental group and the concurrent control group. Reading grade-level-equivalent scores of each student in the study were collected for (1) each of the three test areas--Word Knowledge or Word Study Skills, Reading Comprehension, and Total Reading; (2) each grade level at each school; and (3) each year of the study. Arithmetic grade-level-equivalent scores were collected for each student in the following test areas: Concepts, Computation, Application, and Total Arithmetic. These were collected at each grade level except second grade, where no scores were reported for Application.

There are two exceptions to the above description. Two of the control schools, one in each of the two control groups, did not report scores for a particular grade level. One grade level was not reported in each case.

Overall, this had no significant effect on the number of participants in the control groups. Both control groups contained over 200 scores at each of the two grade levels where scores were not reported. The second exception concerns the sixth grade level of the experimental group in the baseline comparison. The experimental school reported only six scores the first year of the comparison (1975); therefore, no comparison of the control group and the experimental group was possible at the sixth grade level for the first year. Sufficient scores were reported at the sixth grade level for the succeeding two years of the study (1976 and 1977).

As noted earlier, the Primary III Battery of the Stanford Achievement Test was not available for the first year of the baseline comparison, but it was given to the experimental group in 1976 and 1977. Since the baseline group was only tested once, in 1975, it was necessary to make an adjustment in the baseline control group data at the fourth grade level--the level at which the Primary III test was supposed to be administered. The adjustment was made by subtracting the third grade mean scores from the fifth grade mean scores of each control school and dividing them in half. The resulting figure was added to the individual 1975 third grade scores for each of the three test areas for each control school. This was accomplished by using the Statistical Package for the Social Sciences (SPSS). The adjustment was used as the control group fourth grade standard. The experimental group scores for 1976 and 1977 were compared against this standard.

The data gathered using the MAT were converted to SAT grade-level-equivalents using a conversion table (Stanford Research Report, 1973). This conversion of MAT scores to SAT scores was completed before the data were analyzed statistically; consequently, all data reported in this study are in the form of grade-level-equivalents based on the Stanford Achievement Test, 1973 edition. The data gathered for each of the two comparisons were independently analyzed, and the data collected each year of the study also were analyzed separately. Comparisons between the years of the study and between the two sets of data were made and significant trends reported.

The data for all comparisons of reading and arithmetic were statistically analyzed by use of a T-test. The T-test was used to analyze the difference of the means of each school and the means of the experimental group and each of the control groups. The T-test was selected because it is a parametric test, and parametric tests are considered to be more power-efficient than non-parametric tests (Ferguson, 1976). The assumptions of a T-test may be significantly violated without affecting the result of the test (Baker, 1966). The comparisons, though numerous, required the comparing of only two means in any given situation; therefore, a T-test was more efficient than a simple analysis of variance which could have been used.

The NAU Xerox Sigma 6 Computer with the software SPSS was used to calculate T-scores for reading; the University of New Mexico IBM computer with the software SPSS was used to calculate T-scores for arithmetic. The SPSS Subprogram T-Test: Comparison of Sample Means was used to calculate T-scores; the specific program used to calculate T-scores was the Comparison of Means--Independent Samples Populations with Common Variance. The following formulas were used in this program (Nie, 1975):

$$S^2 = \frac{(n_1-1)s_1^2 + (n_2-1)s_2^2}{(n_1-1) + (n_2-1)}$$

$$S_{\bar{d}}^2 = (s^2/n_1 + s^2/n_2)$$

$$T_{\bar{d}} = \frac{(X_1 - X_2)}{S_{\bar{d}}}$$

$$df = (n_1 + n_2 - 2)$$

The .05 level of confidence was used as the criterion level for determining significant difference; this level was selected because it is a recognized standard. The English proficiency component of the study did not require a statistical analysis. A visual analysis of the mean scores was conducted.

## FINDINGS OF THE STUDY

### Reading

The primary purpose of this study was to compare two approaches for introducing reading in English to Navajo children. The EFL direct method approach introduced children to reading in English only; systematic TESL techniques were used in this approach. Children received at least one year of instruction in oral English before beginning actual reading in English. The bilingual method approach introduced children to reading in Navajo first. The children developed reading proficiency in the native language before they were transferred to English reading. These children developed an oral proficiency in English while they were learning to read in Navajo.

The assessment of the reading component of the study involved two separate comparisons, which will be referred to in this chapter as the baseline comparison and concurrent comparison. The baseline comparison required testing over a three-year period at grades two through six. The concurrent comparison was composed of data collected over a one-year period. The testing conducted in this comparison included grades two through six.

The statistic selected to analyze the data collected was a T-test of the difference in the means of the experimental group and the control groups. The T-test statistic was used in both the baseline and concurrent comparisons. The appropriate T-value is reported for each comparison of the experimental group and the control group. The T-value reported for a given comparison is either a T-value where the variance was pooled or a T-value where the variance was separate. The criteria for determining which T-value is reported was whether the f ratio of the experimental group's variance and the control group's variance was significant or not significant. If the level of significance of the f ratio was larger than the .05 level of significance, the T-value for pooled variance is reported. If the level of significance of the f ratio was at the .05 level of significance or smaller, the T-value for separate variance is reported.

The findings of the reading component are presented in the following organizational format. The data is presented for each of the two comparisons separately. The baseline comparison findings appear first, followed by the concurrent comparison findings. A common sequence for presenting the findings is followed in both comparisons. The sequence is derived from the hypotheses established in the problem of the study. The sequence is as follows: (1) comparison of achievement in total reading at each grade level (second through sixth); (2) comparison of achievement in the sub-skill areas of word

knowledge skills or word study skills and of comprehension at each grade level (second through sixth); (3) comparison of growth rates in total reading.

**Baseline Comparison.** The data presented in this section were collected over a three-year period. The experimental group was tested in February, 1975, February, 1976, and February, 1977. The control group was tested once--in February, 1975. Each year's data of the experimental group are compared to the 1975 data of the control group, except at the fourth grade level. Therefore, there are three separate sets of comparisons in this section, one set for each year. The three sets of data for a particular comparison are presented and described together, e.g. the three T-test analysis tables of data for the comparison of student achievement in total reading at the second grade level are displayed and discussed as a unit.

The T-test analysis of comparisons between the second grade experimental group and the second grade control group in *total reading achievement* appear in Tables 2, 3, and 4. Table 2 shows that the control group scores were significantly higher than the experimental group scores in 1975. Table 3 and Table 4 display the 1976 and the 1977 comparison results. The control group scores were higher than the experimental group scores both years, but the differences in the scores were not significant.

Tables 5, 6, and 7 display the T-test analyses of the third grade level comparisons in total reading. The experimental group scores were higher than the control group all three years. Table 6 shows that the experimental group scores were significantly higher in 1976, but a significant level was not reached in 1975 or in 1977 as indicated in Tables 5 and 7.

The T-test analyses of the fourth grade comparisons in total reading appear in Tables 8, 9, and 10. The experimental group scores were significantly higher than the control group scores in 1975 and 1976, as depicted in Tables 8 and 9. The T-values for both years were beyond the .001 level of significance. Table 10 shows that the experimental group scores were higher than the control group scores in 1977, but the difference in the scores was not significant.

Tables 11, 12, and 13 display the T-test analyses of the fifth grade comparisons for each year of the study. The experimental group scores were significantly higher than the control scores all three years. The T-values were all beyond the .001 level of significance. The T-test analyses for the sixth grade comparisons are exhibited in Tables 14 and 15. No comparison was conducted for 1975 at the sixth grade level. The experimental group scores were significantly higher than the control group scores in both 1976 and 1977. The T-values were both beyond the .001 level of significance.

The comparisons of second grade students in *word study skills* appear in Tables 16, 17, and 18. Tables 16 and 17 show that the control group scores were significantly higher than the experimental group scores in 1975 and 1976. The control group scores were higher than the experimental group scores in 1977, but the scores were not significantly higher. Tables 19, 20, and 21 display the T-test analyses of comparisons of second grade students in comprehension skills. The control group scores were higher than the experimental group scores all three years, but only in 1975 (Table 19) were the control group scores significantly higher than the experimental group scores.

The T-test analyses of the comparisons of third grade achievement in word study skills are exhibited in Tables 22, 23, and 24. The experimental group scores were higher than the control groups' scores all three years, but the .05 level of significance was reached only in the 1976 comparison (Table 23). Tables 25, 26, and 27 display the T-test analyses of the comparisons of achievement in comprehension skills of third grade students. There was no

difference in the mean scores of the experimental group and the control group in 1975 (Table 25). The experimental group scores were higher than the control group scores in 1976 and 1977 (Tables 26 and 27) and significantly higher in 1976.

The comparisons of fourth grade student achievement in word study skills appear in Tables 28, 29, and 30. The T-test analyses of these comparisons indicate that the experimental group scores were significantly higher than control group scores in all three years of the study. The T-test analyses of the comparisons of achievement in comprehension skills are exhibited in Tables 31, 32, and 33. Tables 31 and 32 show that the experimental group scores were higher than the control group scores and were beyond the .05 level of significance in 1976 (Table 32). The 1977 experimental group scores were below the control group scores but the difference was not significant.

Tables 34, 35, and 36 display the T-test analyses of the comparisons of achievement in word study skills of fifth grade students. The three tables show that the experimental groups' scores were significantly higher than the control group scores all three years of study. The level of significance for the three T-values displayed in these tables was beyond the .001 level. The T-test analyses of the comparisons of achievement in comprehension skills appear in Tables 37, 38, and 39. The experimental group scores were higher than the control groups' scores all three years. Tables 37, 38, and 39 show the differences in the means were significant in all three comparisons.

The comparisons of sixth grade achievement in word study skills appear in Tables 40 and 41. The T-test analyses of each of the comparisons indicates that the experimental group scores were significantly higher than the control group scores in 1976 and 1977. The difference in the means in each of the comparisons was significant beyond the .001 level. Comparisons of sixth grade achievement in comprehension skills are exhibited in Tables 42 and 43. These tables show that the experimental group scores were higher than the control group scores in 1976 and 1977. The difference in the means in both comparisons was significant at or beyond the .001 level.

The *rates of growth* of the experimental group and the control group were not statistically analyzed. They were determined in the following manner: the grade-level-equivalent score mean of the lowest grade was subtracted from the grade-level-equivalent score mean of the highest grade; the difference was then divided by the number of years of growth. The following is an example of the computation procedures.

| | | |
|---|---|---|
| Highest grade: | sixth grade mean | 6.63 |
| Lowest grade: | second grade mean | -1.94 |
| | | 4.69 |

Number of years of growth: 4 years

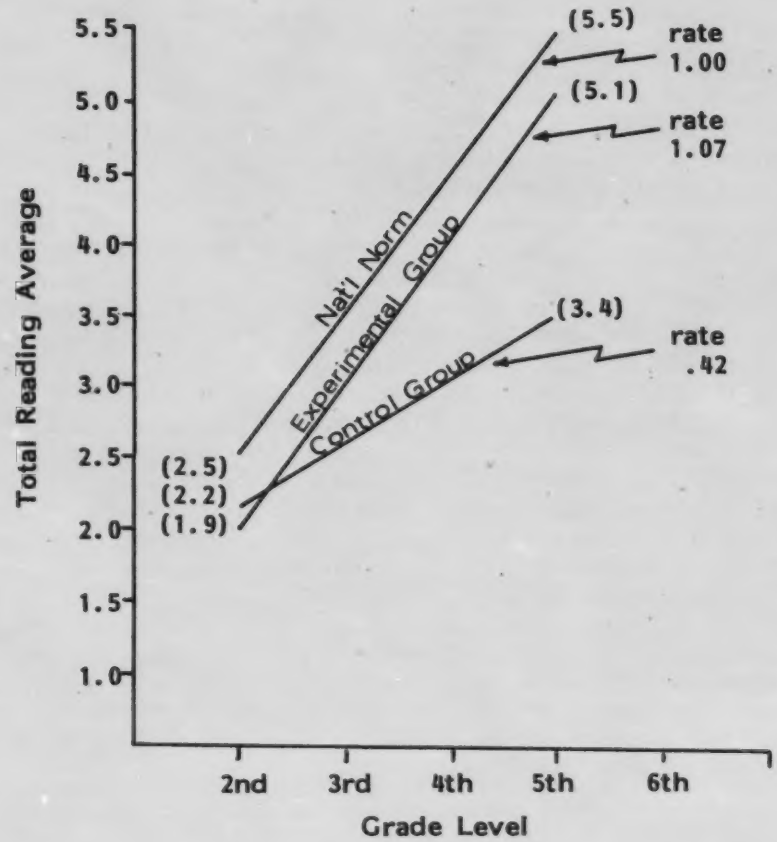
$$4.69 \div 4 = 1.18 \text{ growth rate}$$

Graph 1 shows that the growth rate of the experimental group in 1975 was 1.07; the control group growth rate that year was .42. The growth rates of the experimental group and control group were 1.18 and .50 respectively in 1976 (Graph 2). The growth rate of the two groups in 1977 (Graph 3) was .99 for the experimental group and .50 for the control group.

Concurrent Comparison. The concurrent comparison involved a one-year period. Students in both the experimental group and in the control group were tested in April, 1976. The Metropolitan Achievement Test (MAT) was the instrument used to test student achievement. The MAT scores were

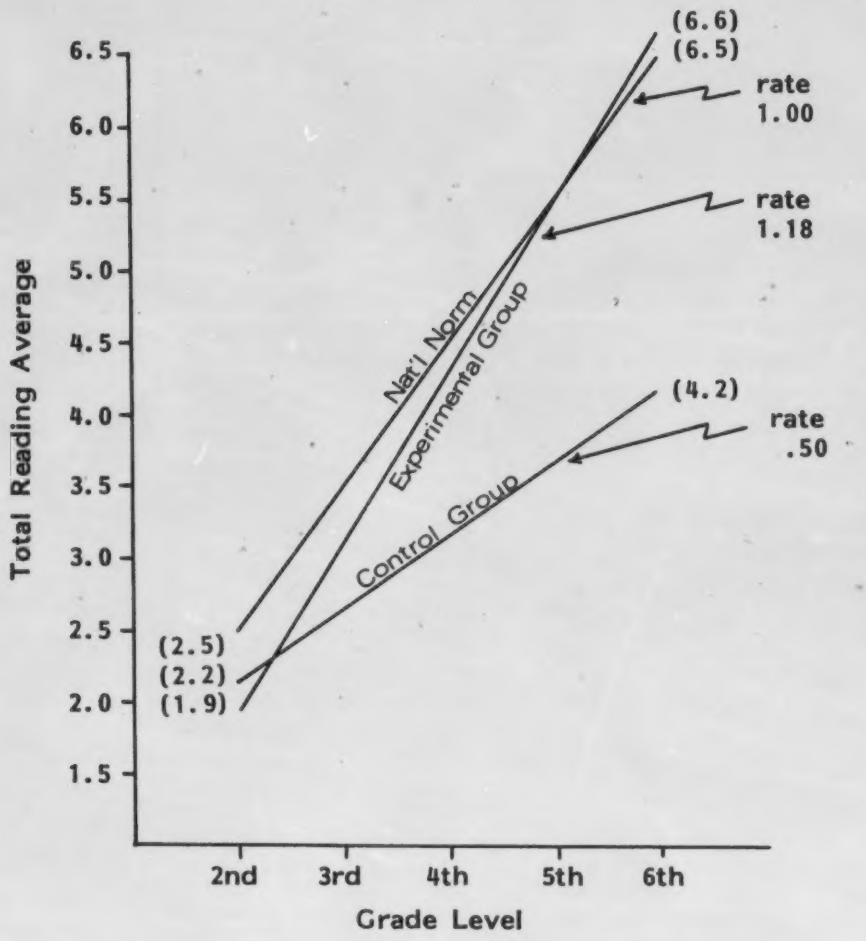
Graph 1

*Baseline Comparison 1975:*
*The Growth Rates of the Experimental Group and the Control Group*



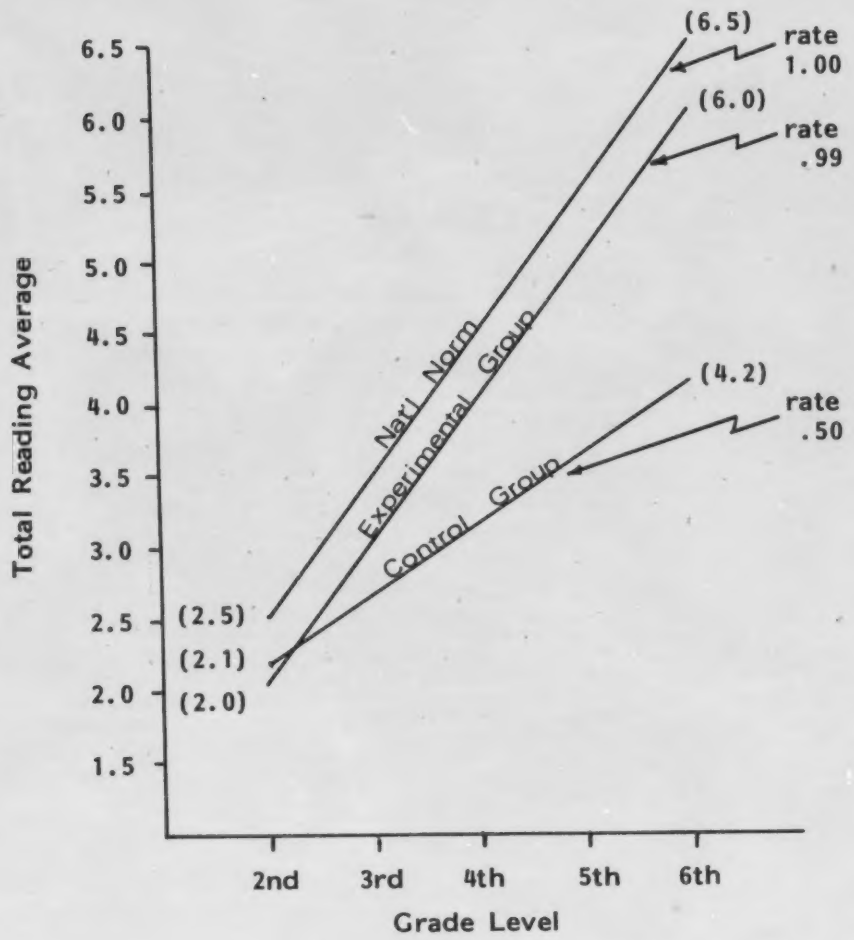
## Graph 2

*Baseline Comparison 1976:*
*The Growth Rate of the Experimental Group and the Control Group*



Graph 3

*Baseline Comparison 1977:*
*The Growth Rates of the Experimental Group and the Control Group*



reported in the form of grade-level-equivalent scores. The MAT grade-level-equivalent scores were converted to Stanford Achievement Test (SAT) grade-level-equivalent scores. Therefore, the data presented in this section are consistent with the data presented in the baseline comparison.

The format of this section is similar to the format of the previous section. The primary difference is that this section presents data collected over a one-year period, rather than over a three-year period. The data presented in this section was analyzed using a T-test to determine if the difference in the means of a given comparison of the experimental group and the control group was significant.

The comparison of the second grade students' achievement in *total reading* is exhibited in Table 72. The T-test analysis showed no significant difference in the groups' means, but the control group scored higher than the experimental group. Table 73 displays the T-test analysis of the comparison of the third grade students in total reading. The analysis indicated that the experimental group scored significantly higher than the control group. The T-test analysis of fourth grade students' achievement in total reading appears in Table 74. The experimental group scores were significantly higher than the control group scores.

The comparison of fifth grade students' achievement in total reading appears in Table 75. The T-test analysis of the difference in the mean of the experimental group and the mean of the control group showed that the experimental group mean was significantly higher than the control group mean.

Table 76 displays the comparison of sixth grade students in total reading. The T-test analysis indicated that the experimental group scored significantly higher than the control group.

Table 77 contains the comparison of second grade students' achievement in *word knowledge skills*. Table 78 displays the comparison of second grade students' achievement in *reading comprehension*. The control group scored higher than the experimental group in both comparisons. The T-test analyses of both comparisons showed that the differences in group means were not significant. The comparison of third grade students' achievement in word knowledge skills is exhibited in Table 79. The comparison of third grade student achievement in reading comprehension appears in Table 80. The T-test analyses in Table 79 and in Table 80 revealed that the experimental group scored higher than the control group, but the difference in the scores was not significant in either comparison.

The T-test analyses of the comparisons of fourth grade student achievement in word knowledge skills and in reading comprehension appear in Tables 81 and 82. The results of the analyses indicated that the experimental group scores were significantly higher than the control group scores in both comparisons. The comparisons of fifth grade students' achievement in word knowledge skills and in reading comprehension appear in Tables 83 and 84. The T-test analyses of both comparisons indicated that the experimental students' achievement was significantly higher than the control students' achievement. The results of both comparisons are significant beyond the .001 level.

Table 85 depicts the comparison of sixth grade students' achievement in word knowledge skills. Table 86 displays the comparison of student achievement in reading comprehension. The T-test analyses of both comparisons showed that the experimental group achievement was significantly higher than the control group achievement. The T-values in both comparisons were significant beyond the .001 level.

The *growth rates* for the concurrent comparison were determined using the same procedures described for the baseline comparison. No statistical

analysis was used to compare the growth rate of each group.

Graph 4 displays the growth rates for each group and the national norm. The control group growth rate was .52. The experimental group growth rate was .84, and the national norm growth rate was 1.00.

Summary. The analysis of the reading achievement data provides the following results, which are expressed in general statements. These results are based on both the baseline comparison and the concurrent comparison and on data collected over a three-year period.

(1) The comparisons conducted at the second grade level revealed that the control group achievement generally was higher than the experimental group achievement. The control group scores were significantly higher than the experimental group scores in six of 20 comparisons made at the second grade level.

(2) The comparisons at the third grade level showed that the experimental group achievement generally was equal to or greater than the control group achievement. The experimental group means were significantly higher than the control group means in six of 20 comparisons.

(3) The comparisons of achievement at the fourth grade level revealed that generally the experimental group scores were higher than the control group scores. The experimental group means were significantly higher than the control group means in 15 of 20 comparisons.

(4) The fifth grade level comparisons showed that the experimental group means were significantly higher than the control group means in all 20 comparisons.

(5) The sixth grade level comparisons revealed that the experimental group scores were significantly higher than the control group scores in all 15 comparisons.

## Arithmetic

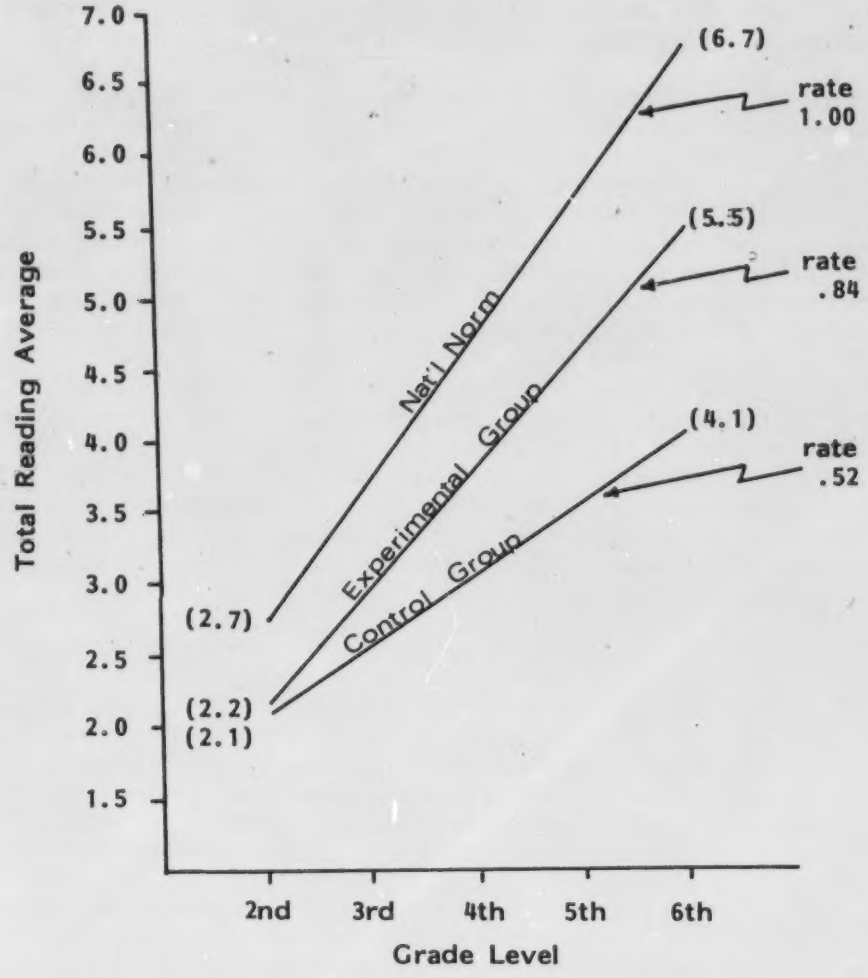
The arithmetic component of the study was a comparison of achievement of children who were initially introduced to arithmetic in Navajo with children who were introduced to arithmetic in English only. The comparison was conducted in February, 1975, and children in grades two through six were tested. The test instrument was the Stanford Achievement Test, and four subtests were administered--Arithmetic Concepts, Arithmetic Computation, Arithmetic Application, and Total Arithmetic. The subtest Arithmetic Application was not available for second grade.

The data gathered were analyzed with a T-test, using the program contained in the computer software SPSS. The data at each grade level are presented in the following subsections: comparisons in total arithmetic and comparisons in the subskills. The T-test value report is the appropriate value for a particular comparison. Pooled variance scores were used if the f ratios were at .06 or greater levels of significance; separate variance scores were reported if the f ratios were at .05 or less levels of significance.

Comparisons in Total Arithmetic. Table 101 provides a description of the comparison of the second grade experimental and control groups in total arithmetic. The control group mean score was significantly higher than the experimental group. The comparison of third grade student scores in total arithmetic appears in Table 102. The control group scored slightly higher, but not significantly higher, than the experimental group. The comparison of fourth grade students in total arithmetic achievement appears in Table 103. The table shows that the experimental group scored significantly higher. The T-value was 3.22 which is beyond the .05 level of significance. Table 104

Graph 4

*Concurrent Comparison:*
*The Growth Rates of the Experimental Group and the Control Group*



depicts the comparison of fifth grade student scores. The experimental group students scored significantly higher than control group students. The level of significance of the T-value was beyond the .001 level.

**Comparisons in the Subskills.** Tables 105 and 106 display the comparisons of second grade students in arithmetic concepts and arithmetic computation. The control group scores were higher on both subskills comparisons. The control group scores were significantly higher on arithmetic concepts. The comparisons of third grade students in arithmetic concepts, arithmetic computation, and arithmetic application appear in Tables 107, 108, and 109. The control group scored higher than the experimental group on all three subskills. The control group scores were significantly higher on arithmetic application.

The comparisons of fourth grade students in arithmetic concepts, arithmetic computation, and arithmetic application are displayed in Tables 110, 111, and 112. The experimental group scored higher than the control group in all three comparisons. The experimental student scores were significantly higher in the comparisons of arithmetic concepts and arithmetic computation. Tables 113, 114, and 115 exhibit the comparisons of fifth grade students in arithmetic concepts, arithmetic computation, and arithmetic application. The experimental group scores were significantly higher in all three comparisons. No sixth grade comparisons were conducted because only six scores were reported for the experimental group at this level.

**Summary.** A summary of the comparisons of student achievement in arithmetic appears in Table 116. The control group scores were higher than the experimental group scores at the second and third grade levels. The control group scores were significantly higher than the experimental group scores in three of seven comparisons at these levels. At the fourth and fifth grade levels the experimental group scored higher than the control group in all eight comparisons. In seven of these comparisons, the experimental student scores were significantly higher.

## English Proficiency

The English proficiency component was a comparison of the achievement of Rock Point students with Chinle Agency student achievement and with Navajo Area student achievement. The Test of Proficiency in English as a Second Language (TOPESL) was administered to all students in grades four through six. The Navajo Area and Chinle Agency schools administered the test in 1974; Rock Point administered the test in 1975 and 1976. The data gathered for each year at Rock Point were compared to the 1974 data gathered at Navajo Area and Chinle Agency schools. A visual analysis of the data is provided.

The TOPESL test is intended as a measure of proficiency in English for non-native speakers and has three subtests--English Structure, Listening Comprehension, and Oral Comprehension. In this case, only the first two were used. The English Structure test has a maximum of 62 points, the Listening Comprehension test, 40 points; the scores have been converted to percentages to allow comparison. The TOPESL has little "top"--it was normed on native speakers of English of the same age, and native speakers should achieve almost 100 percent.

The results of the comparisons of Rock Point students and the Navajo Area and Chinle Agency students appear in Tables 117 and 118. A comparison of the Rock Point 1975 student achievement and the Chinle Agency and Navajo Area 1974 student achievement is presented in Table 117. The comparison on

the subtest English Structure shows that Rock Point fourth graders' mean score was equal to the mean score of the Navajo Area sixth graders. Rock Point fourth graders, on the average, scored higher than the Chinle Agency sixth grade student average score.

The comparison on the Listening Comprehension subtest reveals that the Rock Point fourth grade mean score is higher than both the mean score of the Navajo Area and the mean score of the Chinle Agency. Rock Point fourth graders scored 19 percentage points higher than the Chinle Agency fifth graders and 10 percentage points higher than the Navajo Area fifth graders. Table 118 displays a comparison of 1976 Rock Point achievement with the 1974 Chinle Agency and Navajo Area achievement. At each grade level Rock Point mean scores are higher than Navajo Area or Chinle Agency mean scores.

The achievement of Rock Point students was higher than the achievement of both Navajo Area and Chinle Agency students at all grade levels tested. In 1975, Rock Point fourth graders scored as high as or higher than the Navajo Area sixth graders in English proficiency. Both in 1975 and 1976, Rock Point fifth graders scored substantially higher than Navajo Area sixth graders on both subtests.

## NOTES

1. For these tables, see the dissertation, which is available on microfilm through University Microfilms, Ann Arbor, Mich., and which is listed in *Dissertation Abstracts International A: Humanities and Social Sciences* 38:1167.
2. The Primary III Level was not available from the publisher in 1975. The Primary II Level was administered to the fourth grade that year, but the Primary III Level was given in 1976 and 1977.

Table 2. *Baseline Comparison 1975: T-Test Analysis of Grade-Level-Equivalent Scores of Second Grade Students in Total Reading.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 44 | 1.90 | .44176 | -3.35 | 92 | .001 |
| Control Group | 215 | 2.16 | .64063 | | | |

Table 3. *Baseline Comparison 1976: T-Test Analysis of Grade-Level-Equivalent Scores of Second Grade Students in Total Reading.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 31 | 1.94 | .49713 | -1.82 | 244 | .071 |
| Control Group | 215 | 2.16 | .64063 | | | |

Table 4. *Baseline Comparison 1977: T-Test Analysis of Grade-Level-Equivalent Scores of Second Grade Students in Total Reading.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 25 | 2.02 | .74537 | -1.02 | 238 | .308 |
| Control Group | 215 | 2.16 | .64063 | | | |

**Table 5.** *Baseline Comparison 1975: T-Test Analysis of Grade-Level-Equivalent Scores of Third Grade Students in Total Reading.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 54 | 2.31 | .46068 | 1.05 | 112 | .296 |
| Control Group | 220 | 2.22 | .65690 | | | |

**Table 6.** *Baseline Comparison 1976: T-Test Analysis of Grade-Level Equivalent Scores of Third Grade Students in Total Reading.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 42 | 2.54 | .62080 | 2.88 | 260 | .004 |
| Control Group | 220 | 2.22 | .65690 | | | |

**Table 7.** *Baseline Comparison 1977: T-Test Analysis of Grade-Level-Equivalent Scores of Third Grade Students in Total Reading.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 33 | 2.34 | .46769 | 1.23 | 53 | .222 |
| Control Group | 220 | 2.22 | .65690 | | | |

**Table 8.** *Baseline Comparison 1975: T-Test Analysis of Grade-Level-Equivalent Scores of Fourth Grade Students in Total Reading.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 40 | 3.23 | 1.0214 | 3.95 | 45 | .000* |
| Control Group | 277 | 2.57 | .73201 | | | |

**Table 9.** *Baseline Comparison 1976: T-Test Analysis of Grade-Level-Equivalent Scores of Fourth Grade Students in Total Reading.***

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 38 | 3.22 | .60887 | 3.88 | 256 | .000* |
| Control Group | 220 | 2.80 | .62335 | | | |

**Table 10.** *Baseline Comparison 1977: T-Test Analysis of Grade-Level-Equivalent Scores of Fourth Grade Students in Total Reading.***

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 39 | 2.95 | .88491 | 1.05 | 45 | .297 |
| Control Group | 220 | 2.80 | .62335 | | | |

**Indicates a level of significance beyond the .001 level*
***Control group scores statistically created using SPSS in 1976 and 1977*
*(See page 50 for explanation)*

**Table 11.** *Baseline Comparison 1975: T-Test Analysis of Grade-Level-Equivalent Scores of Fifth Grade Students in Total Reading.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 27 | 5.10 | .91586 | 7.81 | 352 | .000* |
| Control Group | 327 | 3.41 | 1.0866 | | | |

**Table 12.** *Baseline Comparison 1976: T-Test Analysis of Grade-Level-Equivalent Scores of Fifth Grade Students in Total Reading.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 24 | 5.66 | 1.5570 | 6.94 | 25 | .000* |
| Control Group | 327 | 3.41 | 1.0866 | | | |

**Table 13.** *Baseline Comparison 1977: T-Test Analysis of Grade-Level-Equivalent Scores of Fifth Grade Students in Total Reading.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 29 | 4.51 | 1.1130 | 5.18 | 354 | .000* |
| Control Group | 327 | 3.41 | 1.0866 | | | |

**Indicates a level of significance beyond the .001 level*

Table 14. *Baseline Comparison 1976: T-Test Analysis of Grade-Level-Equivalent Scores of Sixth Grade Students in Total Reading.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 23 | 6.63 | 1.2385 | 9.36 | 297 | .000* |
| Control Group | 276 | 4.16 | 1.2110 | | | |

Table 15. *Baseline Comparison 1977: T-Test Analysis of Grade-Level-Equivalent Scores of Sixth Grade Students in Total Reading.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 21 | 5.72 | 1.2041 | 5.70 | 295 | .000* |
| Control Group | 276 | 4.16 | 1.2110 | | | |

Table 16. *Baseline Comparison 1975: T-Test Analysis of Grade-Level-Equivalent Scores of Second Grade Students in Word Study Skills.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 44 | 2.05 | .34463 | -4.38 | 196 | .000* |
| Control Group | 215 | 2.43 | .98210 | | | |

**Indicates a level of significance beyond the .001 level*

**Table 17.** *Baseline Comparison 1976: T-Test Analysis of Grade-Level-Equivalent Scores of Second Grade Students in Word Study Skills.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 31 | 2.12 | 5.2645 | -2.65 | 65 | .010 |
| Control Group | 215 | 2.43 | .98210 | | | |

**Table 18.** *Baseline Comparison 1977: T-Test Analysis of Grade-Level-Equivalent Scores of Second Grade Students in Word Study Skills.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 25 | 2.20 | .30727 | -1.13 | 238 | .261 |
| Control Group | 215 | 2.43 | .98210 | | | |

**Table 19.** *Baseline Comparison 1975: T-Test Analysis of Grade-Level-Equivalent Scores of Second Grade Students in Comprehension Skills.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 44 | 1.84 | .46377 | -2.28 | 257 | .024 |
| Control Group | 215 | 2.05 | .55827 | | | |

Table 20. *Baseline Comparison 1976: T-Test Analysis of Grade-Level-Equivalent Scores of Second Grade Students in Comprehension Skills.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 31 | 1.86 | .46377 | -1.72 | 244 | .087 |
| Control Group | 215 | 2.05 | .55827 | | | |

Table 21. *Baseline Comparison 1977: T-Test Analysis of Grade-Level-Equivalent Scores of Second Grade Students in Comprehension Skills.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 25 | 1.92 | .74593 | -.86 | 27 | .399 |
| Control Group | 215 | 2.05 | .55827 | | | |

Table 22. *Baseline Comparison 1975: T-Test Analysis of Grade-Level-Equivalent Scores of Third Grade Students in Word Study Skills.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 54 | 2.51 | .82379 | 1.85 | 272 | .066 |
| Control Group | 220 | 2.24 | .98428 | | | |

Table 23. *Baseline Comparison 1976: T-Test Analysis of Grade-Level-Equivalent Scores of Third Grade Students in Word Study Skills.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 42 | 2.51 | .61897 | 2.32 | 86 | .023 |
| Control Group | 220 | 2.24 | .98428 | | | |

Table 24. *Baseline Comparison 1977: T-Test Analysis of Grade-Level-Equivalent Scores of Third Grade Students in Word Study Skills.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 33 | 2.30 | .52411 | .58 | 72 | .564 |
| Control Group | 220 | 2.24 | .98428 | | | |

Table 25. *Baseline Comparison 1975: T-Test Analysis of Grade-Level-Equivalent Scores of Third Grade Students in Comprehension Skills.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 54 | 2.25 | .45753 | .04 | 115 | .971 |
| Control Group | 220 | 2.25 | .66510 | | | |

Table 26. *Baseline Comparison 1976: T-Test Analysis of Grade-Level-Equivalent Scores of Third Grade Students in Comprehension Skills.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 42 | 2.63 | .81541 | 3.22 | 260 | .001 |
| Control Group | 220 | 2.25 | .66751 | | | |

Table 27. *Baseline Comparison 1977: T-Test Analysis of Grade-Level-Equivalent Scores of Third Grade Students in Comprehension Skills.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 33 | 2.45 | .69769 | 1.60 | 251 | .111 |
| Control Group | 220 | 2.25 | .66751 | | | |

Table 28. *Baseline Comparison 1975. T-Test Analysis of Grade-Level-Equivalent Scores of Fourth Grade Students in Word Study Skills.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 40 | 3.28 | 1.3394 | 3.51 | 44 | .001 |
| Control Group | 277 | 2.51 | .92013 | | | |

**Table 29.** *Baseline Comparison 1976: T-Test Analysis of Grade-Level Equivalent Scores of Fourth Grade Students in Word Study Skills.***

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 38 | 3.61 | 1.3471 | 4.42 | 44 | .000* |
| Control Group | 220 | 2.60 | .94176 | | | |

**Table 30.** *Baseline Comparison 1977: T-Test Analysis of Grade-Level-Equivalent Scores of Fourth Grade Students in Word Study Skills.***

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 39 | 2.93 | .97795 | 2.00 | 257 | .047 |
| Control Group | 220 | 2.60 | .94176 | | | |

**Table 31.** *Baseline Comparison 1975: T-Test Analysis of Grade-Level Equivalent Scores of Fourth Grade Students in Comprehension Skills.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 40 | 3.22 | .79701 | 4.61 | 315 | .000* |
| Control Group | 277 | 2.63 | .75864 | | | |

**Indicates a level of significance beyond the .001 level*
***Control group scores statistically created using SPSS in 1976 and 1977*
*(See page 50 for explanation)*

Table 32. *Baseline Comparison 1976: T-Test Analysis of Grade-Level Equivalent Scores of Fourth Grade Students in Comprehension Skills.***

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 38 | 3.13 | .57313 | 1.04 | 256 | .296 |
| Control Group | 220 | 3.01 | .62156 | | | |

Table 33. *Baseline Comparison 1977: T-Test Analysis of Grade-Level-Equivalent Scores of Fourth Grade Students in Comprehension Skills.***

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 39 | 2.95 | .92560 | -.39 | 44 | .701 |
| Control Group | 220 | 3.01 | .62156 | | | |

Table 34. *Baseline Comparison 1975: T-Test Analysis of Grade-Level-Equivalent Scores of Fifth Grade Students in Word Study Skills.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 27 | 4.52 | .85979 | 8.17 | 36 | .000* |
| Control Group | 327 | 3.05 | 1.2645 | | | |

**Indicates a level of significance beyond the .001 level*
***Control group scores statistically created using SPSS in 1976 and 1977*
*(See page 50 for explanation)*

Table 35. *Baseline Comparison 1976: T-Test Analysis of Grade-Level-Equivalent Scores of Fifth Grade Students in Word Study Skills.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 24 | 5.68 | 2.2154 | 5.74 | 24 | .000* |
| Control Group | 327 | 3.05 | 1.2645 | | | |

Table 36. *Baseline Comparison 1977: T-Test Analysis of Grade-Level-Equivalent Scores of Fifth Grade Students in Word Study Skills.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 29 | 4.51 | 1.0833 | 5.18 | 354 | .000* |
| Control Group | 327 | 3.05 | 1.2645 | | | |

Table 37. *Baseline Comparison 1975: T-Test Analysis of Grade-Level-Equivalent Scores of Fifth Grade Students in Comprehension Skills.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 27 | 5.39 | 1.1832 | 7.14 | 352 | .000* |
| Control Group | 327 | 3.78 | 1.1200 | | | |

**Indicates a level of significance beyond the .001 level*

**Table 38.** *Baseline Comparison 1976: T-Test Analysis of Grade-Level-Equivalent Scores of Fifth Grade Students in Comprehension Skills.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 24 | 5.67 | 1.4810 | 6.11 | 25 | .000* |
| Control Group | 327 | 3.78 | 1.1200 | | | |

**Table 39.** *Baseline Comparison 1977: T-Test Analysis of Grade-Level-Equivalent Scores of Fifth Grade Students in Comprehension Skills.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 29 | 4.50 | 1.5200 | 2.46 | 31 | .020 |
| Control Group | 327 | 3.78 | 1.1200 | | | |

**Table 40.** *Baseline Comparison 1976: T-Test Analysis of Grade-Level-Equivalent Scores of Sixth Grade Students in Word Study Skills.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 23 | 6.83 | 1.0928 | 11.41 | 297 | .000* |
| Control Group | 276 | 3.88 | 1.1996 | | | |

**Indicates a level of significance beyond the .001 level*

Table 41. *Baseline Comparison 1977: T-Test Analysis of Grade-Level-Equivalent Scores of Sixth Grade Students in Word Study Skills.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 21 | 5.72 | 1.2041 | 5.37 | 21 | .000* |
| Control Group | 276 | 4.16 | 1.2110 | | | |

Table 72. *Concurrent Comparison: T-Test Analysis of Grade-Level-Equivalent Scores of Second Grade Students in Total Reading.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 30 | 2.07 | .54263 | -1.05 | 49 | .298 |
| Control Group | 204 | 2.19 | .52868 | | | |

Table 73. *Concurrent Comparison: T-Test Analysis of Grade-Level-Equivalent Scores of Third Grade Students in Total Reading.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 38 | 2.94 | .84708 | 2.27 | 247 | .024 |
| Control Group | 211 | 2.65 | .68800 | | | |

**Indicates a level of significance beyond the .001 level*

Table 74. *Concurrent Comparison: T-Test Analysis of Grade-Level-Equivalent Scores of Fourth Grade Students in Total Reading.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 31 | 3.10 | .57330 | 4.89 | 21 | .000* |
| Control Group | 250 | 2.64 | .75172 | | | |

Table 75. *Concurrent Comparison: T-Test Analysis of Grade-Level-Equivalent Scores of Fifth Grade Students in Total Reading.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 22 | 4.90 | 1.3990 | 4.89 | 21 | .000* |
| Control Group | 362 | 3.43 | .63052 | | | |

Table 76. *Concurrent Comparison: T-Test Analysis of Grade-Level-Equivalent Scores of Sixth Grade Students in Total Reading.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 21 | 5.53 | 1.1341 | 5.46 | 22 | .000* |
| Control Group | 237 | 4.14 | .84209 | | | |

**Indicates a level of significance beyond the .001 level*

**Table 77.** *Concurrent Comparison: T-Test Analysis of Grade-Level-Equivalent Scores of Second Grade Students in Word Knowledge Skills.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 30 | 1.95 | .49810 | -1.36 | 50 | .178 |
| Control Group | 204 | 2.09 | .74314 | | | |

**Table 78.** *Concurrent Comparison: T-Test Analysis of Grade-Level-Equivalent Scores of Second Grade Students in Reading Comprehension.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 30 | 2.02 | .59678 | -.97 | 47 | .335 |
| Control Group | 204 | 2.14 | .82684 | | | |

**Table 79.** *Concurrent Comparison: T-Test Analysis of Grade-Level-Equivalent Scores of Third Grade Students in Word Knowledge Skills.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 38 | 2.78 | .73111 | 1.53 | 247 | .127 |
| Control Group | 211 | 2.58 | .75877 | | | |

**Table 80.** *Concurrent Comparison: T-Test Analysis of Grade-Level-Equivalent Scores of Third Grade Students in Reading Comprehension.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 38 | 2.80 | 1.1686 | 1.53 | 43 | .132 |
| Control Group | 211 | 2.50 | .81077 | | | |

**Table 81.** *Concurrent Comparison: T-Test Analysis of Grade-Level-Equivalent Scores of Fourth Grade Students in Word Knowledge Skills.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 31 | 2.84 | .53895 | 2.51 | 279 | .013 |
| Control Group | 250 | 2.54 | .64313 | | | |

**Table 82.** *Concurrent Comparison: T-Test Analysis of Grade-Level-Equivalent Scores of Fourth Grade Students in Reading Comprehension.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 31 | 3.29 | .75954 | 3.56 | 276 | .000* |
| Control Group | 250 | 2.68 | .91515 | | | |

**Indicates a level of significance beyond the .001 level*

**Table 83.** *Concurrent Comparison: T-Test Analysis of Grade-Level-Equivalent Scores of Fifth Grade Students in Word Knowledge Skills.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 22 | 4.35 | 1.0400 | 5.32 | 22 | .000* |
| Control Group | 360 | 3.15 | .70603 | | | |

**Table 84.** *Concurrent Comparison: T-Test Analysis of Grade-Level-Equivalent Scores of Fifth Grade Students in Reading Comprehension.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 22 | 5.40 | 1.6059 | 5.74 | 21 | .000* |
| Control Group | 362 | 3.47 | .7714 | | | |

**Table 85.** *Concurrent Comparison: T-Test Analysis of Grade-Level-Equivalent Scores of Sixth Grade Students in Word Knowledge Skills.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 21 | 5.30 | .89581 | 6.46 | 256 | .000* |
| Control Group | 237 | 4.22 | .72265 | | | |

**Indicates a level of significance beyond the .001 level*

**Table 86.** *Concurrent Comparison: T-Test Analysis of Grade-Level-Equivalent Scores of Sixth Grade Students in Reading Comprehension.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 21 | 5.97 | 1.1620 | 6.08 | 256 | .000* |
| Control Group | 237 | 4.48 | 1.0670 | | | |

**Table 101.** *T-Test Analysis of Grade-Level-Equivalent Scores of Second Grade Students in Total Arithmetic.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 45 | 2.11 | 0.568 | -3.18 | 100.9 | .002 |
| Control Group | 203 | 2.44 | 0.908 | | | |

**Table 102.** *T-Test Analysis of Grade-Level-Equivalent Scores of Third Grade Students in Total Arithmetic.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 53 | 2.37 | 0.458 | -1.59 | 114.1 | .115 |
| Control Group | 220 | 2.49 | 0.688 | | | |

**Indicates a level of significance beyond the .001 level*

**Table 103.** *T-Test Analysis of Grade-Level-Equivalent Scores of Fourth Grade Students in Total Arithmetic.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 43 | 3.29 | 0.668 | 3.22 | 3.19 | .001 |
| Control Group | 278 | 2.35 | 0.847 | | | |

**Table 104.** *T-Test Analysis of Grade-Level-Equivalent Scores of Fifth Grade Students in Total Arithmetic.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 27 | 5.02 | 0.696 | 8.11 | 36.1 | .000* |
| Control Group | 312 | 3.84 | 1.004 | | | |

**Table 105.** *T-Test Analysis of Grade-Level-Equivalent Scores of Second Grade Students in Total Arithmetic Concepts.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 45 | 2.02 | 0.621 | -3.89 | 106.0 | .000* |
| Control Group | 203 | 2.48 | 1.034 | | | |

**Indicates a level of significance beyond the .001 level*

**Table 106.** *T-Test Analysis of Grade-Level-Equivalent Scores of Second Grade Students in Total Arithmetic Computation.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 45 | 2.33 | 0.557 | -1.11 | 35.9 | .269 |
| Control Group | 203 | 2.44 | 0.771 | | | |

**Table 107.** *T-Test Analysis of Grade-Level-Equivalent Scores of Third Grade Students in Total Arithmetic Concepts.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 53 | 2.51 | 0.475 | -1.15 | 277 | .253 |
| Control Group | 226 | 2.63 | 0.735 | | | |

**Table 108.** *T-Test Analysis of Grade-Level-Equivalent Scores of Third Grade Students in Total Arithmetic Computation.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 53 | 2.87 | 0.620 | -0.65 | 277 | .516 |
| Control Group | 266 | 2.94 | 0.722 | | | |

**Table 109.** *T-Test Analysis of Grade-Level-Equivalent Scores of Third Grade Students in Total Arithmetic Application.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 53 | 2.06 | 0.590 | -1.97 | 277 | .050 |
| Control Group | 266 | 2.30 | 0.842 | | | |

**Table 110.** *T-Test Analysis of Grade-Level-Equivalent Scores of Fourth Grade Students in Total Arithmetic Concepts.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 43 | 3.50 | 0.878 | 3.55 | 319 | .000* |
| Control Group | 278 | 2.95 | 0.961 | | | |

**Table 111.** *T-Test Analysis of Grade-Level-Equivalent Scores of Fourth Grade Students in Total Arithmetic Computation.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 43 | 3.70 | 0.691 | 3.65 | 319 | .000* |
| Control Group | 278 | 3.22 | 0.814 | | | |

**Indicates a level of significance beyond the .001 level*

Table 112. *T-Test Analysis of Grade-Level-Equivalent Scores of Fourth Grade Students in Total Arithmetic Application.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 43 | 3.04 | 0.835 | 1.62 | 66.7 | .110 |
| Control Group | 278 | 2.81 | 1.098 | | | |

Table 113. *T-Test Analysis of Grade-Level-Equivalent Scores of Fifth Grade Students in Total Arithmetic Concepts.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 27 | 5.00 | 0.898 | 5.56 | 337 | .000* |
| Control Group | 312 | 3.82 | 1.057 | | | |

Table 114. *T-Test Analysis of Grade-Level-Equivalent Scores of Fifth Grade Students in Total Arithmetic Computation.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 27 | 4.86 | 0.728 | 2.31 | 337 | .021 |
| Control Group | 312 | 4.40 | 0.993 | | | |

**Indicates a level of significance beyond the .001 level*

Table 115. *T-Test Analysis of Grade-Level-Equivalent Scores of Fifth Grade Students in Total Arithmetic Application.*

| School | Number of Cases | Mean | Standard Deviation | T Value | Degrees of Freedom | Level of Significance |
|---|---|---|---|---|---|---|
| Experimental Group | 27 | 5.12 | 1.030 | 7.67 | 337 | .000* |
| Control Group | 312 | 3.42 | 1.107 | | | |

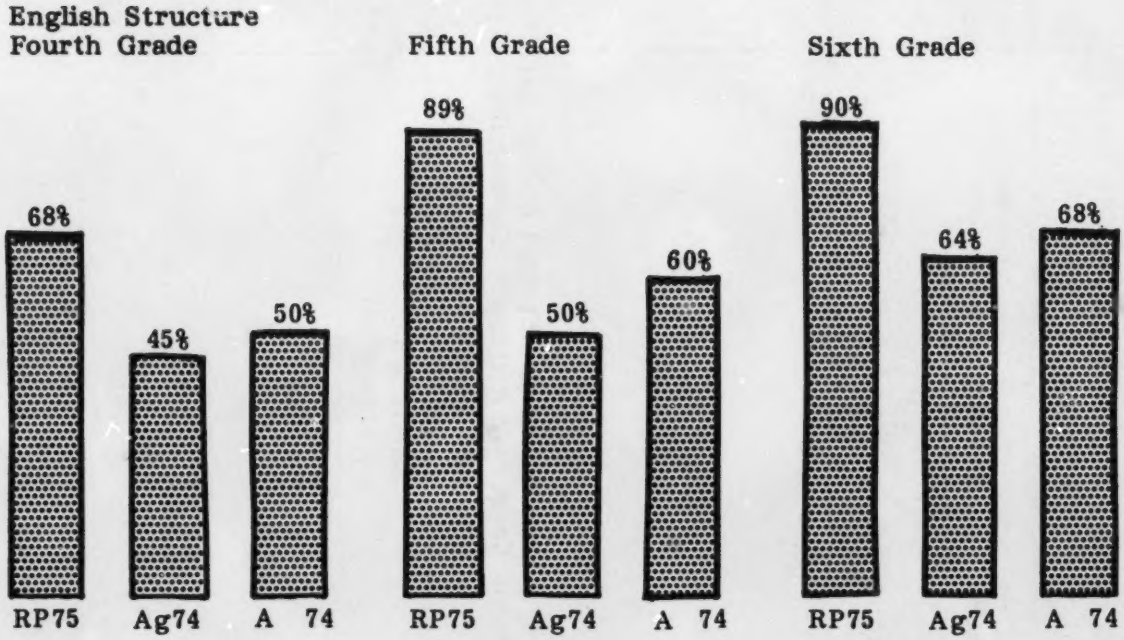
*Indicates a level of significance beyond the .001 level

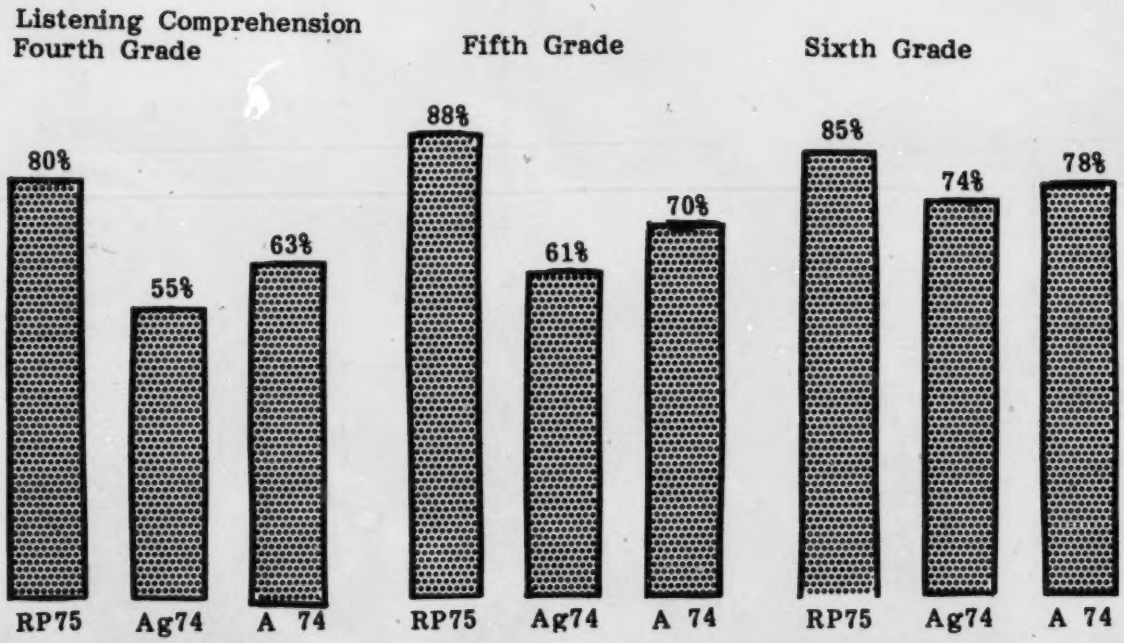
Table 116. *Summary of Arithmetic Data: The .05 Level of Significance Was Obtained or Was Not Obtained for Each Comparison--Total Arithmetic, Arithmetic Concepts, Arithmetic Computation, and Arithmetic Application.*

| Grade | Total Arithmetic | Arithmetic Concepts | Arithmetic Computation | Arithmetic Application |
|---|---|---|---|---|
| 2 | yes[b] | yes[b] | no | c |
| 3 | no | no | no | yes[b] |
| 4 | yes[a] | yes[a] | yes[a] | no |
| 5 | yes[a] | yes[a] | yes[a] | yes[a] |

*(a) Indicates the experimental group mean was significantly higher*
*(b) Indicates the control group mean was significantly higher*
*(c) This level of the test did not provide a subskill test for arithmetic application*

Table 117
*TOPESL--March 1975*

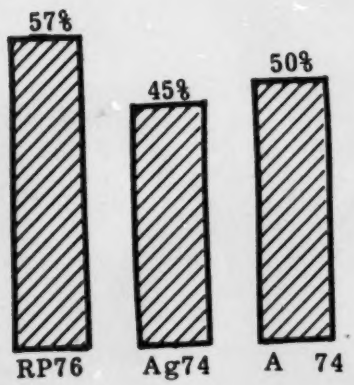


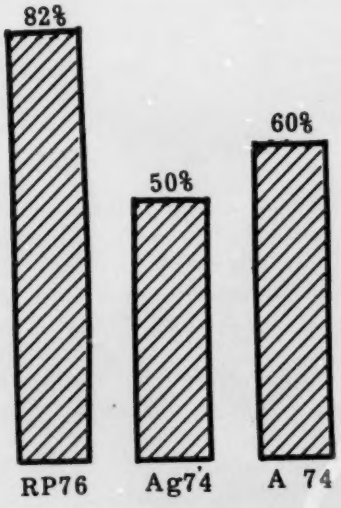
Appendix B

Table 118
*TOPESL--March 1976*

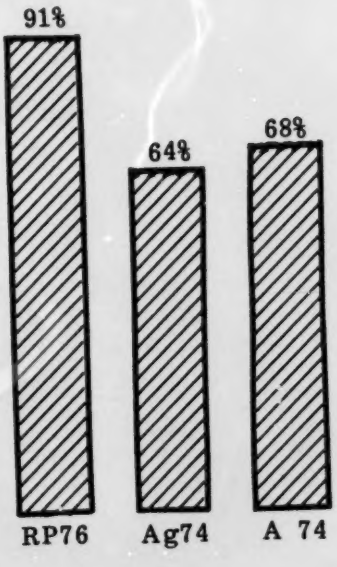
English Structure
Fourth Grade



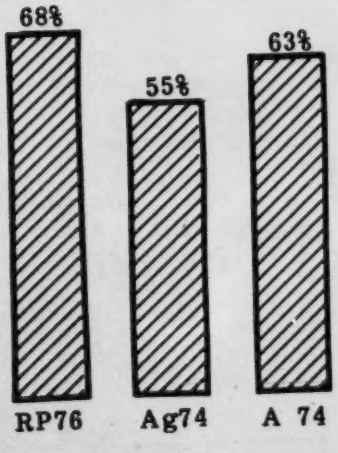

Fifth Grade



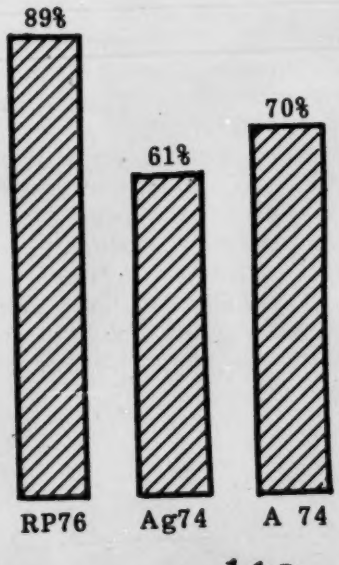

Sixth Grade




Listening Comprehension
Fourth Grade




Fifth Grade

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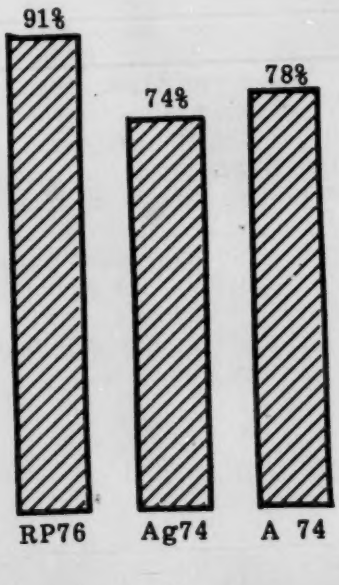

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